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WATER RESOURCE ENGINEERS

TOWN OF MIDDLEBURY, VERMONT

SEWER SYSTEM EVALUATION STUDY – PHASE I

SEPTEMBER 2013

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TABLE OF CONTENTS

TABLE OF CONTENTS

TABLE OF CONTENTS

SECTION 1

EXECUTIVE SUMMARY

SECTION 1 EXECUTIVE SUMMARY

The Town of Middlebury believes that groundwater infiltration and/or stormwater inflow contribute significant volumes of extraneous water to the sanitary sewer collection system during wet weather periods. The Town retained Aldrich + Elliott, PC to prepare a Sewer System Evaluation Study (SSES) to determine the location and magnitude of infiltration/inflow in the wastewater collection system. The purpose of the SSES is to identify those areas within the wastewater collection system that appear to be accepting excessive infiltration and/or inflow (I/I), estimate the volume of infiltration and inflow and make recommendations for further evaluation.

In 2010 the Town completed an upgrade to the Main Pump Station which added an expanded wet well and grit removal facilities to reduce overflows at the station to be in compliance with the State of Vermont CSO Control Policy and to reduce the amount of grit accumulating in the forcemain. The pumps were originally designed to discharge up to 6.2 mgd with two (2) pumps running. The operators indicated that the 6.2 mgd was achieved during the first few years of operations, but a steady decrease was observed after. The accumulation of grit in the forcemain before the grit removal facilities were installed is the likely cause.

The Town also has concerns about the physical condition of the manholes and sewerline for the Exchange Street trunk sewer that runs between Seymour Street and the Cabot plant mostly along the railroad tracks. Manhole inspections were performed for the manholes along the Exchange Street truck sewer to assess the physical condition of the manholes, sewerline and make recommendations for further evaluation or rehabilitation.

Besides the Main Pump Station, the Town owns, operates and maintains eighteen (18) other wastewater pump stations. The flow data and meter readings for each of these pump stations were evaluated to assess the dry weather base flows and wet weather contribution for each individual service area based on the pump station flows. The magnitude of the I/I based on the wastewater pumping was evaluated for each pump station service area. There were four (4) pump station service areas identified with excessive I/I that were recommended for night-time flow gauging:

- High School Pump Station (PS #1)
- Seminary Pump Station (PS #6)
- Weybridge Pump Station (PS #9)
- Halladay Pump Station (PS #12)

Night-time flow gauging was initially scheduled to be conducted during the spring and fall of 2012. Due to low snowfall in the winter of 2011/2012, an extremely dry spring of 2012, with seasonally low precipitation totals and exceptionally low seasonal high groundwater, the night-time flow gauging was pushed back until 2013. The night-time flow gauging was performed in the spring of 2013 to insure that flow measurement was performed during periods of high groundwater flows.

The first night of night-time flow gauging was conducted on April 11, 2013. Flow was measured in twenty two (22) manholes. The second night of flow gauging was conducted on May 1, 2013. Flow was measured in twelve (12) manholes. For new construction, an infiltration allowance of 300 gal/day/in-mile is assumed. Any unit flow greater than 1,500 gal/day/in-mile is considered excessive

for this study. Twenty two (23) pipe segments totaling 15,093 lineal feet were deemed to have an excessive amount of infiltration and are summarized in Table 1.1.

Table 1.1
Areas Recommended for Phase II- Sewer System Evaluation Summary of Areas with Excessive Infiltration

Priority Ranking	Service Areas/ Street	Segment Location	Pipe Length (feet)
1	PS#9- Weybridge St	09-013 / 09-015	400
2	PS#1 – Woodland Park	0701 / 0092	360
3	PS#9- Cross Country	09-003 / 09-001W	635
4	PS#1- Monroe St. CC	0693 / 0690	590
5	PS#12- Middle Rd S	12-001 / Unmarked #1	650
6	PS#6- Seminary St. Ext. CC	06-021 / 06-028	1,326
7	PS#6- Washington St.	06-040 / 06-039	117
8	PS#1- Buttolph Dr.	0659 / 0701	330
9	PS#6- Seminary St. Ext.	06-014 / 06-021	85
10	PS#1- HS Area	0682 / 0681	385
11	PS#6- Colonial Drive S.	06-046 / 06-052	415
12	PS#12- RT 7/Cady Rd.	Unnumbered / 12-008	500
13	PS#1- HS Area	0682 / 0673	835
14	PS#1- Charles Ave	0673 / 0677	960
15	PS#12- RT 7/Foote St	12-005 / 12-006	170
16	PS#1 – Buttolph Drive	0655 / 0659	230
17	PS#12- RT 7/Middle Rd.	12-004 / 12-005	90
18	PS#6- Colonial Drive	06-039 / 06-051	830
19	PS#12- Middle Rd S	Unmarked #3 / End of US 7	2,520
20	PS#1 – Woodland Park	0701 / 0095	890
21	PS#6- Peterson Terr.	06-028 / 06-029	540
22	PS#6- Seminary St. Ext.	06-014 / 06-024	1,600
23	PS#9- Weybridge St	09-011 / 09-022	635
		Totals	**15,093**

These 23 segments are recommended for a Phase II Sewer System evaluation study consisting of manhole inspections and sewerline flushing/TV inspections. The light flushing and TV inspection typically costs approximately $2.00 per linear foot of pipeline which would make the total cost of flushing and TV inspection approximately $40,000.

Fourteen (14) manhole structures along the Exchange Street trunk sewer were inspected on December 20, 2013. The deficiencies of these manholes included:

- Significant bacterial slime growth on the walls.
- Minor deterioration and spalling of concrete walls.
- Root growth on walls,
- Infiltration in some manholes.

- Slip lined pipe penetrating too far into the manhole causing flow restrictions.

Recommendations for manhole rehabilitation are included in the report.

Pump capacity testing at the Main Pumping Station indicates that the existing flow meter is reading approximately 14% low. Even with the flow meter error, the existing pumps are pumping approximately 5.1 mgd instead of the original 6.2 mgd. Based on measuring system pressure and calculating the C factor based on calculated forcemain head loss, it is likely that the low pumping rate and higher system pressure is the result of grit accumulated in the forcemain.

Standard poly pigging operations were evaluated for pigging the forcemain and determined to be not viable because of the likelihood of the pig getting stuck. These conditions include:

- No pig insertion or retrieval stations.
- Two (2) 90° bends at the WWTF.
- Two (2) wyes in the forcemain with straight runs against closed valves.
- Change in pipe size from 16" to 18".
- Volume of fluid needed for pigging vs. the volume of wet well storage available before overflow.

A review and pricing for ice pigging of the forcemain was performed. Ice pigging is an innovative/alternative method of pigging forcemains. Ice pigging combines the operational advantages of flushing with the cleaning impact of soft pigging. The ice pig is a semi-solid that is pumped like a liquid and flows through changes in diameter, bends and fittings without blockage. Ice pigging has a minimum impact on operations. The ice pig is simply pumped into the system and either melts in the pipe or is recovered at the WWTF without excavation.

The cost of ice pigging the forcemain is a total of $108,000 or a unit price cost of $36,000 for the 1st three (3) days and $12,000 per day if operations are conducted or $6,000 per day if cancelled early.

SECTION 2

INTRODUCTION

SECTION 2 INTRODUCTION

2.1 BACKGROUND

The Town of Middlebury is located in Addison County in the central western portion of Vermont as shown on Figure No. 1 (Location Plan). Under the Phase I sewer system investigation, pump station flow evaluations, manhole inspections and night-time flow gauging were performed. Figures are provided in Appendix A showing the areas that were investigated and inspected.

The Town maintains a wastewater collection system as shown on Figure No. 2 (Wastewater Collection System Map). There are thirty four (34) pump stations within the collection system of which eighteen are owned and maintained by the Town. Ultimately, the majority of the wastewater flow is conveyed to the Main Pump Station located at the end of Lucius Shaw Lane. This pump station conveys the wastewater through a forcemain to the wastewater treatment facility (WWTF) located at the end of Industrial Avenue for treatment prior to discharge to the Otter Creek River.

The age of various collection systems range from relatively new to very old. Earlier systems were not necessarily designed to keep infiltration from entering the collection system.

In 2010 the Town completed an upgrade to the Main Pump Station which added an expanded wet well and grit removal facilities to reduce overflows at the station to be in compliance with the State of Vermont CSO Control Policy and to reduce the amount of grit accumulating in the forcemain. The pumps were originally designed to discharge up to 6.2 mgd with two (2) pumps running. The operators indicated that the 6.2 mgd was achieved during the first few years of operations, but a steady decrease was observed after. The accumulation of grit in the forcemain before the grit removal facilities were installed is the likely cause.

The Town of Middlebury believes that groundwater infiltration and/or stormwater inflow contribute significant volumes of extraneous water to the sanitary sewer collection system during wet weather periods. The Town retained Aldrich + Elliott, PC to prepare a Sewer System Evaluation Study (SSES) to determine the location and magnitude of infiltration/inflow in the wastewater collection system.

There have been overflows at Pump Station No. 9 which do not meet the State of Vermont CSO Control Policy.

The Town also has concerns about the physical condition of the manholes and sewerline for the Exchange Street trunk sewer that runs between Seymour Street and the Cabot plant mostly along the railroad tracks.

2.2 PURPOSE

The purpose of the SSES is to identify those areas within the wastewater collection system that appear to be accepting excessive infiltration and/or inflow, estimate the volume of infiltration and inflow and make recommendations for further evaluation. Continuous flow metering within the Pump Station No. 9 collection system was performed to identify areas of inflow and make recommendations for further evaluation. Manhole inspections were performed for the manholes along the Exchange

Street truck sewer to assess the physical condition of the manholes, sewerline and make recommendations for further evaluation or rehabilitation.

2.3 SCOPE OF SERVICES

The scope of this project is to present the findings of the SSES and to make recommendations for further evaluation and includes the following:

- Review of existing data and records
- Review of pump station pump run times to prioritize each pump station for I/I analysis.
- Manhole inspections to identify locations for night-time flow gauging.
- Two (2) nights of night-time flow gauging to determine areas of excessive infiltration
- Analysis of flow gauging results and prioritizing areas of excessive infiltration
- Identify areas for further evaluation.
- One (1) day of manhole inspections for the Exchange Street trunk sewer.
- Flow capacity testing at the Main Pump Station.
- Evaluate alternatives for regaining capacity at the Main Pumping Station.
- Recommendations
- Conduct project review meetings
- Report

SECTION 3

PUMP STATION FLOW EVALUATION

SECTION 3 PUMP STATION FLOW EVALUATION

3.1 GENERAL

Besides the Main Pump Station, the Town owns, operates and maintains eighteen (18) other wastewater pump stations. The flow data and meter readings for each of these pump stations were evaluated to assess the dry weather base flows and wet weather contribution for each individual service area based on the pump station flows. Pump hour meter data for pump stations are summarized for the period of January 1, 2009 to December 31, 2011. Graphs of the estimated flows for each pump station using the pump run times are provided in Appendix B.

The wet weather flow periods for each pump station were compared to the dry weather flow periods to estimate the extent of the annual infiltration/inflow contribution for each service area. The magnitude of the I/I based on the wastewater pumping was evaluated for each pump station service area. Pump station service areas identified with excessive I/I were recommended for night-time flow gauging. The remaining pump station service areas were eliminated from further evaluation.

3.2 HIGH SCHOOL PUMP STATION (PS #1)

The flow data shows that the High School service area does exhibit substantial infiltration/inflow. The flow through the High School Pump Station averaged approximately 30,000 gallons per day during the summer and winter months of 2009 thru 2011, or yearly baseline as depicted on the graphs in Appendix B. During the spring months, the average flow was approximately 45,000 gpd. The data shows that there is a 50% increase in the spring wet weather flow over the dry weather flow.

Because the sewer service area showed substantial infiltration/inflow, it was evaluated further.

3.3 MIDDLEBURY COMMONS PUMP STATION (PS #2)

The flow data shows that the Middlebury Commons Pump Station service area exhibits minimal infiltration/inflow. Flows during the dry weather periods average approximately 4,300 gpd. During wet weather periods flow increase to approximately 5,100 gpd.

Because the sewer service area does not show any substantial infiltration, it was eliminated from further evaluation.

3.4 WEYBRIDGE PUMP STATION (PS #3)

The flow data shows that the Weybridge Pump Station No. 3 service area exhibits significant infiltration/inflow during wet weather periods. The flow through the Weybridge Pump Station averaged 210,000 gpd during dry weather periods from 2009 to 2011. During wet weather periods, flow increased by approximately 70,000 to 120,000 gpd to a total of approximately 280,000 gpd to 330,000 gpd. On average wet weather flows increase approximately 33% over the dry weather flows.

Even though this service exhibits significant infiltration, the Town did not want to evaluate this service area further because it is actively undertaking sewer system rehabilitation projects in this area.

3.5 FROG HOLLOW PUMP STATION (PS #4)

The flow data shows that the Frog Hollow Pump Station service area exhibits minimal infiltration/inflow. The baseline flow through the Frog Hollow Pump Station during dry weather flows is approximately 20,000 gpd. The flow through the Frog Hollow Pump Station during wet weather flow periods averaged approximately 27,000 gpd.

The actual total infiltration increase per day is negligible in comparison with other pump stations and did not warrant further investigation at this time.

3.6 ROUTE 125 PUMP STATION (PS #5)

The flow data shows that the Route 125 Pump Station service area exhibits moderate infiltration/inflow during wet weather periods. The average flow during dry weather periods is approximately 4,500 gpd. In contrast, the wet weather flows averaged approximately 10,600 gpd.

The actual total infiltration increase per day is negligible in comparison with other pump stations and did not warrant further investigation at this time.

3.7 SEMINARY PUMP STATION (PS #6)

The flow data shows that the Seminary Pump Station service area exhibits substantial infiltration/inflow. The flow during dry weather periods averaged approximately 26,000 gpd. The flows experienced during wet weather periods in the spring at the Seminary Pump Station averaged approximately 43,000 gpd. The 17,000 gpd increase during wet weather periods is approximately 65% greater than dry weather periods.

Because the sewer service area showed substantial infiltration/inflow, it was evaluated further.

3.8 ROGERS PUMP STATION (PS #7)

The flow data shows that the Rogers Pump Station service area exhibits substantial infiltration/inflow. The data shows that approximately 75,000 gpd passed through the Rogers Pump Station during dry weather periods from 2009 to 2011. During wet weather flows in that same time frame, the Rogers Pump Station experienced increases of flows from 35,000 to 140,000 gpd. The 140,000 gpd difference between dry and wet weather flow periods was experienced in 2011.

The Halliday Pump Station pumps through to the Rogers Pump Station. Since the higher I/I flows at this station are attributed to the Halliday Pump Station, this service area did not warrant further investigation at this time.

3.9 SEYMOUR PUMP STATION (PS #8)

The flow data shows that the Seymour Pump Station experienced minor infiltration/inflow during the 2009 to 2011 time period. The dry weather flow is approximately 2,200 gpd. During wet weather periods, the flow increase to an average of approximately 3,100 gpd.

The actual total infiltration increase per day is negligible in comparison with other pump stations and did not warrant further investigation.

3.10 WEYBRIDGE PUMP STATION (PS #9)

The flow data shows that the Weybridge Pump Station service area exhibits substantial infiltration/inflow. The average dry weather flow for 2009 to 2011 is approximately 37,000 gpd. In comparison, the wet weather flows during the same time periods increased by approximately 35,000 gpd to a total of 72,000 gpd. The average increase of wet weather flow to dry weather flow is approximately 95%.

Because the sewer service area showed substantial infiltration/inflow and has a history of overflows, it was evaluated further.

3.11 GREEN MOUNTAIN PUMP STATION (PS #10)

The flow data shows that the Green Mountain Pump Station service area exhibits minimal infiltration/inflow. The dry weather flows in 2009 thru 2011 ranged from approximate 2,000 to 3,250 gpd. The wet weather flows ranged from approximately 6,000 to 8,000 gpd.

The actual total flow infiltration increase per day is negligible in comparison with other pump stations and did not warrant further investigation.

3.12 BAKERY PUMP STATION (PS #11)

The flow data shows that the Bakery Pump Station service area exhibits minimal infiltration/inflow. The data shows that approximately 6,000 gpd passed through the Bakery Pump Station during dry weather flow periods. In contrast, the flow through the pump station increased to approximately 7,500 gpd during wet weather periods.

Because the sewer service area did not show any substantial infiltration/inflow, it was eliminated from further evaluation.

3.13 HALLADAY PUMP STATION (PS #12)

The flow data show that the Halladay Pump Station service area exhibits substantial infiltration/inflow. Based on the 2009 to 2011 flow data, an average of 41,000 gpd passed through the pump station during dry weather flow periods. The wet weather flow increased to an average of 68,000 gpd.

Because the sewer service area showed substantial infiltration/inflow, it was evaluated further.

3.14 HALPIN PUMP STATION (PS #13)

The flow data shows that the Halpin Pump Station service area exhibits moderate infiltration/inflow. The dry weather flows ranged from approximately 5,250 to 6,000 gpd during 2009 to 2011. Wet weather flows increased between approximately 9,000 to 11,000 gpd.

The actual total flow infiltration increase per day is negligible in comparison with other pump stations and did not warrant further investigation at this time.

3.15 PAINTER PUMP STATION (PS #14)

The flow data shows that the Painter Pump Station service area exhibits minimal infiltration/inflow. The dry weather flow averaged approximately 2,000 gpd. Comparatively, the wet weather flow was approximately 4,000 gpd.

The actual total flow infiltration increase per day is negligible in comparison with other pump stations and did not warrant further investigation at this time.

3.16 MEADOW PUMP STATION (PS #15)

The flow data shows that the Meadow Pump Station service area exhibits minimal infiltration/inflow. The dry weather period flows are approximately 2,600 gpd, with an increase of approximately 1,000 gpd during wet weather periods.

Because the sewer service area does not show any substantial infiltration, it was eliminated from further evaluation.

3.17 SOUTH RIDGE PUMP STATION (PS #16)

The flow data shows that the South Ridge Pump Station service area exhibits moderate infiltration/inflow. During dry weather periods in the summer and winter, the average flow is approximately 3,800 gpd. Wet weather flows during the spring increased to approximately 10,000 gpd.

The actual flow infiltration increase per day is negligible in comparison with other pump stations and did not warrant further investigation at this time.

3.18 BATTELL PUMP STATION (PS #26)

The flow data shows that the Battell Pump Station service area does exhibit substantial infiltration/inflow. The baseline flow through the Battell Pump Station during dry weather flows was approximately 33,000 gpd from 2009 to 2011. The flow during that same time period in the spring averaged 61,000 gpd. Wet weather flow increases ranged from 22,000 to 45,000 gpd.

The Town decided that it did not want to look at this service area at this time.

3.19 PUMP STATION SERVICE AREAS RECOMMENDED FOR FURTHER EVALUATION

The following four (4) pump stations exhibit high I/I during the spring and were selected for further investigation:

- High School Pump Station (PS #1)
- Seminary Pump Station (PS #6)
- Weybridge Pump Station (PS #9)
- Halladay Pump Station (PS #12)

The following two (2) pump stations experienced high infiltration/inflow but were not investigated at the request of the Town:

- Roger Pump Station (PS# 7)
- Battell Pump Station (PS# 26)

SECTION 4

NIGHT-TIME FLOW GAUGING

SECTION 4 NIGHT-TIME FLOW GAUGING

4.1 General

Initial meetings were conducted with the operators to identify potential pipe segments and locations which may receive excessive infiltration. Night-time flow gauging was initially scheduled to be conducted during the spring and fall of 2012. Due to seasonally low precipitation totals and exceptionally low seasonal high groundwater, the night-time flow gauging was pushed back until 2013. The night-time flow gauging was performed in the spring of 2013 to insure that flow measurements were performed during periods of high groundwater flow. In most cases, an inspection was conducted of each manhole in advance to verify the structure was clean and suitable for field flow measurement.

On April 11, May 1, and June 6, 2013 between the hours of 11:00 pm and 5:00 am, night-time flow gauging was performed in manhole structures at "key" locations in the four (4) pump station service areas. The night-time flow gauging is conducted in the spring when seasonal high groundwater is typically at its highest. The 1st night was used as a system wide gauging of the priority areas. After the 1st night-time data was analyzed, the locations for the 2nd and 3rd nights were used to further define and isolate the areas of excessive infiltration from the 1st night of gauging. Night-time flow isolation allows for determining the specific reaches of sewer that have excessive infiltration during periods of low sewage use. The typical design allowance for infiltration of new sewerlines is 300 gallons/inch/diameter/mile/day. For this study, excessive flow is defined as flow that exceeds 1,500 gpd/in-mile.

4.2 1st Night on April 11, 2013

4.2.1 General

The 1st night of flow gauging was performed on the evening of April 11, 2013 from the hours of 11:00 pm through 5:00 am. Typically, a larger area is covered on the 1st night to eliminate those areas which do not need further investigation and identify areas that need to be broken down further on the 2nd night. Nathan Pion from Aldrich + Elliott, PC entered manhole structures and measured the actual flows using v-notch weirs installed in the inlet pipelines. Assistance with confined space entry was provided by Paul Lengyel and Dean Rheaume of the Town of Middlebury. Traffic control was utilized as all manhole structures were in high traffic areas. The flow was measured at approximately 22 manholes. The gauging locations are shown on Figure No. 3 thru 6 in Appendix A. The measured flow for each location along with the segment flow and infiltration rate per segment is summarized in Appendix C for the 1st night.

4.2.2 High School Pump Station (PS #1)

Figure No. 3 provides a map of the gauging locations along with the total measured flow, segment flow and infiltration flow rate. The following is a summary of the flow gauging results:

- A significant flow rate (1,755 gpd or 5,036 gpd/in-mi) was calculated in the pipe segment along Buttolph Drive (SMH 0655 to SMH 0659)
- A significant flow rate (11,590 gpd or 1,439 gpd/in-mi) was calculated in the pipe segment along Buttolph Drive (SMH 0659 to the end of Swanage Street/Woodland Park)
- A significant flow rate (5,986 gpd or 2,502 gpd/in-mi) was calculated in the pipe segment near the High School Pump Station (SMH 0693 to SMH 0655)
- A significant flow rate (3,090 gpd or 2,450 gpd/in-mi) was calculated in the pipe segment along Charles Avenue (SMH 0673 to SMH 0677)
- A significant flow rate (4,690 gpd or 8,040 gpd/in-mi) was calculated in the pipe segment near the High School (SMH 0682 to SMH 0681)
- A significant flow rate (6,580 gpd or 4,657 gpd/in-mi) was calculated in the pipe segment near the High School (SMH 0682 to SMH 0673)
- Minimal flow was observed in the following pipe segments and these segments were excluded from further evaluation:
    - Buttolph Drive between SMH 0655 and the end of Monroe Street
    - Buttolph Drive between SMH 0659 and SMH 0644
    - Charles Avenue between SMH 0673 and SMH 0674
    - US 7 between SMH 0677 and SMH 0693
    - US 7 between SMH 0677 and SMH 0647
    - High School Pump Station between SMH 0682 and SMH 0658
    - High School Pump Station between SMH 0693 and Overbrook Drive.

4.2.3 Seminary Pump Station (PS #6)

Figure No. 4 provides a map of the gauging locations along with the total measured flow, segment flow and infiltration flow rate. The following is a summary of the flow gauging results:

- A significant flow rate was calculated along Seminary Street in the following locations:
    - 13,460 gpd or 3,045 gpd/in-mi from SMH 06-001 to the end of Forbes Circle
    - 1,633 gpd or 12,680 gpd/in-mi from SMH 06-014 to SMH 06-021
    - 4,690 gpd or 1,935 gpd/in-mi from SMH 06-014 to Battell Woods Condos
    - 12,782 gpd or 6,362 gpd/in-mi from SMH 06-021 to SMH 06-028
- A significant flow rate was calculated along Washington Street in the following locations:
    - 3,689 gpd or 2,933 gpd/in-mi from SMH 06-039 to the end of Peterson Terrace
    - 9,243 gpd or 3,408 gpd/in-mi from SMH 06-039 to SMH 06-044
    - 5,798 gpd or 32,707 gpd/in-mi from SMH 06-040 to SMH 06-039
- Minimal flow was observed in the following pipe segments and these segments were excluded from further evaluation:
    - Seminary Street between SMH 06-021 to the end of Seminary Street Ext.
    - Washington Street between SMH 06-028 to SMH 06-040
    - Washington Street between SMH 06-044 to SMH 06-041
    - Washington Street SMH 06-040 had an 8" stub with no flow.

4.2.4 Weybridge Pump Station (PS #9)

Figure No. 5 provides a map of the gauging locations along with the total measured flow, segment flow and infiltration flow rate. The following is a summary of the flow gauging results:

- A significant flow rate (2,975 gpd or 2,550 gpd/in-mi) was calculated in the cross country pipe segment near Pump Station No. 9 on Weybridge Street (SMH 09-003 to SMH 09-002W)
- A significant flow rate (1,458 gpd or 1,515 gpd/in-mi) was calculated in the pipe segment along Weybridge Street (SMH 09-011 to SMH 09-022).
- A significant flow rate (16,280 gpd or 12,158 gpd/in-mi) was calculated in the pipe segment along Weybridge Street (SMH 09-013 to SMH 09-015).
- Minimal flow was observed in the following pipe segments and these segments were excluded from further evaluation:
    - Pulp Mill Bridge Road between SMH 09-002W and the end of Otter Creek Lane.
    - Pulp Mill Bridge Road between SMH 09-002W and SMH 09-005W.
    - Pulp Mill Bridge Road between SMH 09-005W and SMH 09-012W.
    - Pulp Mill Bridge Road between SMH 09-005W and SMH 09-0013W(End)
    - Pulp Mill Bridge Road between SMH 09-005W and SMH 09-006W(End)
    - Weybridge Street between SMH 09-011 and SMH 09-012
    - Weybridge Street between SMH 09-011 and SMH 09-013
    - Weybridge Street between SMH 09-013 and SMH 09-023

4.2.5 Halladay Pump Station (PS #12)

Figure No. 6 provides a map of the gauging locations along with the total measured flow, segment flow and infiltration flow rate. The following is a summary of the flow gauging results:

- A significant flow rate (13,850 gpd or 1,814 gpd/in-mi) was calculated in the pipe segment along Middle Road South (SMH 12-001 to SMH 12-004)
- A significant flow rate (1,050 gpd or 7,700 gpd/in-mi) was calculated in the pipe segment along US 7 (SMH 12-004 to SMH 12-005).
- A significant flow rate (24,038 gpd or 3,526 gpd/in-mi) was calculated in the pipe segment along US 7 (SMH 12-004 to an unmarked SMH on the west side of US 7 across from Cady Road)
- A significant flow rate (2,270 gpd or 8,813 gpd/in-mi) was calculated in the pipe segment along US 7 (SMH 12-005 to SMH 12-006)
- A significant flow rate (3,839 gpd or 5,067 gpd/in-mi) was calculated in the pipe segment along Cady Road (Unmarked SMH on the west side of US 7 across from Cady Road to SMR 12-008)
- Minimal flow was observed in the follow pipe segments and these segments were excluded from further evaluation:
    - Foote Street between SMH 12-005 and SMH 12-007
    - Cady Road between SMH 12-008 and SMH 12-010
    - Cady Road between SMH 12-008 and SMH 07-67

- US 7 between unmarked SMH on west side across from Cady Road and SMH 07-66

4.2.6 Summary of 1st Night and Recommendations for 2nd Night

High School Pump Station (PS#1) Service Area

For the High School Pump Station (PS#1) service area, the 1st night of flow gauging resulted in large areas of excessive infiltration as shown on Figure No. 3. It was recommended that a 2nd night of flow gauging be conducted in the PS#1 service area to breakdown the following two (2) large areas into smaller pipe segments:

- Buttolph Drive between SMH 0659 and Swanage Street/Woodland Park.
- Monroe Street between SMH 0693 and SMH 0655.

The following areas of excessive infiltration are relatively small and did not to be broken down further:

- 230 l.f. of sewerline on Buttolph Drive between SMH 0655 and SMH 0659.
- 960 l.f. of sewerline on Charles Avenue between SMH 0673 and 0677
- 385 l.f. of sewerline near the High School Pump Station from SMH 0681 to SMH 0682.
- 835 l.f. of sewerline near the High School Pump Station from SMH 0682 to SMH 0673.

Because these areas of excessive infiltration in the PS#1 service area are relatively small in area, they were directly recommended for Phase II sewer system evaluation (TV and manhole Inspections) without the need to break them down further during the 2nd night. Therefore, the 2nd night of flow gauging was not recommended in these areas of the PS#1 service area.

Seminary Pump Station (PS#6) Service Area

For the Seminary Pump Station (PS#6) service area, the 1st night of flow gauging resulted in some large areas of excessive infiltration as shown on Figure No. 4. It was recommended that a 2nd night of flow gauging be conducted in the PS#6 service area to breakdown the following three (3) large areas into smaller pipe segments:

- Cross country sewerline between Seminary Street Extension (SMH 06-021) and SMH 06-028 where Peterson Terrace enters the sewerline.
- The sewerline from SMH 06-001 near the pump station going south east along Forbes Circle, East Road, and Evergreen Lane to the ends of the sewerlines.
- The sewerline along Washington Street from MH 06-039 at the intersection of the northern leg of Colonial Drive and Peterson Terrace south to the intersection of the southern leg of Colonial Drive including the southern leg of colonial Drive.

The following areas of excessive infiltration are relatively small and did not to be broken down further:

- 85 l.f. of sewerline on Seminary Street from SMH 06-014 to SMH 06-021.
- 1,600 l.f. of sewerline on Seminary Street from SMH 06-14 to the end of the sewerline at Battell Woods Condominiums.
- 830 l.f. of sewerline on northern leg of Colonial Drive from the intersection of Washington Street at SMH 06-039 to the end of the sewerline.
- 117 l.f. of sewerline on Washington Street from SMH 06-039 – SMH 06-040.

Because these areas of excessive infiltration in the PS#6 service area are relatively small in area, they were directly recommended for Phase II sewer system evaluation (TV and manhole Inspections) without the need to break them down further during the 2nd night. Therefore, the 2nd night of flow gauging was not recommended in these areas of the PS#6 service area.

Weybridge Pump Station (PS#9) Service Area

For the Weybridge Pump Station (PS#9) service area, the 1st night of flow gauging results identified three (3) relatively small areas of sewerline segments with excessive infiltration as shown on Figure No. 5 including:

- 790 l.f. along Weybridge Street (SMH 09-013 to SMH 09-015) from the intersection of Morning Drive southeast to the end of the sewer.
- 770 l.f. of cross country sewer (SMH 09-003 to SMH 09-002W) from PS#9 toward Weybridge.
- 635 l.f. of sewerline (SMH 09-011 to SMH 09-022) behind the homes along the west side of Weybridge Street from Pulp Mill Road to Morningside Drive.

Because the areas of excessive infiltration in the PS#9 service area are relatively small in area, they were directly recommended for Phase II sewer system evaluation (TV and manhole Inspections) without the need to break them down further during the 2nd night. Therefore, the 2nd night of flow gauging was not recommended in the PS#9 service area.

Halladay Pump Station (PS#12) Service Area

For the Halladay Pump Station (PS#12) service area, the 1st night of flow gauging resulted in two (2) large areas of excessive infiltration as shown on Figure No. 6 including:

- 2,240 l.f. of sewerline on Middle Road South between SMH 12-001 and SMH 12-003.
- 2,000 l.f. of sewerline on US Route 7/Middle Road South between SMH 12-004 and an unnumbered manhole at the intersection of US 7 and Cady Road.

There are no manholes to break these areas down further, so a 2nd night of flow gauging was not recommended in these areas. These areas are recommended for Phase II sewer system evaluation (TV inspection).

The following areas of excessive infiltration are relatively small and did not need to be broken down further during the 2nd night:

- 90 l.f. of sewerline on US Route 7/Middle Road South between SMH 12-004 and SMH 12-005.
- 170 l.f. of sewerline on US Route 7 and Foote Street between SMH 12-005 and SMH 12-006.
- 500 l.f. of sewerline On US Route 7 and Cady Road between an unnumbered manhole and SMH 12-008.

Because these areas of excessive infiltration in the PS#12 service area are relatively small in area, they were directly recommended for Phase II sewer system evaluation (TV and manhole Inspections) without the need to break them down further during the 2nd night. Therefore, the 2nd night of flow gauging was not recommended in these areas of the PS#12 service area.

4.3 2nd Night on May 1, 2013

4.3.1 General

Using the infiltration flows estimated from the 1st night, locations for gauging were selected within PS#1 and PS#6 service areas for the 2nd night on May 1, 2013. Weather and flow conditions had changed drastically since April 11, 2013. All seasonal thaws had passed and conditions were drier than typically experienced during this time of year. The Town of Middlebury's decided to complete the night-time flow gauging during the spring of 2013, in order to move forward into Phase II of the Sewer System Evaluation Study.

Flow gauging for this night was performed at closer intervals to better assess specific locations and pipe segments. Nathan Pion from Aldrich + Elliott, PC entered manhole structures and measured the actual flows using v-notch weirs temporarily installed in the inlet pipes. Assistance with confined space entry was provided by Paul Lengyel and Dean Rheaume of the Town of Middlebury. The flow was measured at approximately 12 structures on the 2nd night as shown on Figure No. 7 and 8 in Appendix A. It was evident during the second night that the seasonal high groundwater had rescinded. Flows experienced during the 2nd night of flow gauging in the same locations were significantly lower than the 1st night. Flow gauging was performed in the High School Pump Station and Pump Station #6 service areas. This information is summarized in Appendix D and was used to estimate the infiltration from specific pipe segments.

4.3.2 High School Pump Station (PS #1)

Figure No. 7 provides a map of the gauging locations along with the total measured flow, segment flow and infiltration flow rate. The following is a summary of the flow gauging results:

- A significant flow rate (1,618 gpd or 4,643 gpd/in-mi) was calculated in the pipe segment along Buttolph Drive (SMH 0655 to SMH 0659)
- A significant flow rate (7,252 gpd or 14,504 gpd/in-mi) was calculated in the pipe segment along Buttolph Drive (SMH 0659 to SMH 0701)

- A significant flow rate (10,530 gpd to SMH 13,934 gpd/in-mi) was calculated in the pipe segment that flows cross country from Buttolph Drive to US 7 (SMH 0693 to SMH 0655).
- Minimal flow rate was observed in the following pipe segments and these segments were excluded from further evaluation:
    - Buttolph Drive between SMH 0655 and the end of Monroe Street
    - Buttolph Drive between SMH 0659 and SMH 0644
    - Swanage Court between SMH 0701 and SMH 0101
    - Swanage Court between SMH 0701 and SMH 0092
    - Cross Country between SMH 0690 and SMH 0655
    - Cross Country between SMH 0690 and SMH 0654
    - Cross Country between SMH 0693 and Overbrook Drive.

4.3.3 Seminary Pump Station (PS #6)

Figure No. 8 provides a map of the gauging locations along with the total measured flow, segment flow and infiltration flow rate. The following is a summary of the flow gauging results:

- A significant flow rate (2,704 gpd or 1,785 gpd/in-mi) was calculated in the pipe segment along the cross country route to Seminary Street (SMH 06-025 to SMH 06-028)
- A significant flow rate (4,690 gpd or 7,459 gpd/in-mi) was calculated in the pipe segment along Washington Street (SMH 06-046 to SMH 06-052).
- Minimal flow rate was observed in the following pipe segments and these segments were excluded from further evaluation:
    - Seminary Street Extension between SMH 06-003 and SMH 06-005
    - Valley View Drive between SMH 06-005 and Seminary Street.
    - Valley View Drive between SMH 06-005 and East Road
    - Valley View Drive between SMH 06-005 and SMH 06-006
    - Evergreen Lane between SMH 06-007 and SMH 06-011
    - Evergreen Lane between SMH 06-007 and SMH 06-013
    - Cross Country Route between SMH 06-028 and SMH 06-029
    - Cross Country Route between SMH 06-028 and SMH 06-039
    - Washington Street between SMH 06-039 and SMH 06-048
    - Washington Street between SMH 06-039 and SMH 06-046
    - Washington Street between SMH 06-046 and SMH 06-047

4.4 3rd Night on June 6, 2013

4.4.1 General

The 3rd night of flow gauging was performed on the evening of June 6, 2013 from the hours of 11:00 pm through 4:00 am to further define areas of excessive infiltration from the 2nd night of flow gauging. Nathan Pion from Aldrich + Elliott, PC entered manhole structures and measured the actual flows using v-notch weirs installed in the inlet pipelines. Assistance with confined space entry was provided by Paul Lengyel and Victor LaBerge of the Town of Middlebury. The flow was measured at approximately 16 manholes. The gauging locations are shown on Figure No. 9 thru 12

in Appendix A. The measured flow for each location along with the segment flow and infiltration rate per segment is summarized in Appendix E for the 3rd night.

4.4.2 High School Pump Station (PS #1)

Figure No. 9 provides a map of the gauging locations along with the total measured flow, segment flow and infiltration flow rate. The following is a summary of the flow gauging results:

- A significant flow rate (10,428 gpd or 19,118 gpd/in-mi) was calculated in the pipe segment between Swanage Court and Harrow Way (SMH 0701 to SMH 0092).
- A significant flow rate (2,975 gpd or 2,206 gpd/in-mi) was calculated in the pipe segment along Swanage Court (SMH 0701 to SMH 0095).
- Minimal flow was observed in the following pipe segments and these segments were excluded from further evaluation:
    - Harrow Way between SMH 0092 and SMH 0094.
    - Harrow Way between SMH 0092 to the end of Heritage Circle.
    - Woodland Park between SMH 0095 and SMH 0101.

4.4.3 Seminary Pump Station (PS #6)

Figure No. 10 provides a map of the gauging locations along with the total measured flow, segment flow and infiltration flow rate. The following is a summary of the flow gauging results:

- A significant flow rate (11,520 gpd or 2,765 gpd/in-mi) was calculated in the pipe segment along Washington Street Cross Country (SMH 06-028 to the end of Washington Street).
    - Areas of excessive infiltration upstream had been determined in the 2nd night.
- A significant flow rate (1,326 gpd or 2,188 gpd/in-mi) was calculated in the cross country pipe segment along Washington Street Cross Country.
- Minimal flow was observed in the following pipe segments and these segments were excluded from further evaluation:
    - Seminary Street Extension between SMH 06-001 and SMH 06-005.
    - Valley View Drive between SMH 06-005 and Seminary Street.
    - Valley View Drive between SMH 06-005 and East Road.
    - Valley View Drive between SMH 06-005 and SMH 06-007.
    - Evergreen Lane between SMH 06-007 and SMH 06-013.
    - Evergreen Lane between SMH 06-007 and SMH 06-011.
    - Seminary Street Cross Country between SMH 06-021 and SMH 06-026.
    - Seminary Street Extension between SMH 06-021 and SMH 06-023.
    - Washington Street Cross Country between SMH 06-026 and SMH 06-028.
    - Washington Street Cross Country between SMH 06-026 and Washington Street.
    - Peterson Terrace between SMH 06-030 and SMH 06-036.
    - Peterson Terrace between SMH 06-030 and SMH 05-029.

4.4.4 Weybridge Pump Station (PS #9)

Figure No. 11 provides a map of the gauging locations along with the total measured flow, segment flow and infiltration flow rate. The following is a summary of the flow gauging results:

- Minimal flow was observed in the following pipe segments and these segments were excluded from further evaluation:
    - Pulp Mill Bridge Road between 09-001W to the end of Pulp Mill Bridge Road.

4.4.5 Halladay Pump Station (PS #12)

Figure No. 12 provides a map of the gauging locations along with the total measured flow, segment flow and infiltration flow rate. The following is a summary of the flow gauging results:

- A significant flow rate (16,250 gpd or 6,600 gpd/in-mi) was calculated in the pipe segment along Middle Road South (SMH 12-001 to Unmarked #1, which is located at the intersection of Middle Road South and Halladay Road).
- A significant flow rate (14,400 gpd or 2,289 gpd/in-mi) was calculated in the pipe segment along US 7 (Unmarked #3, which is located at the intersection of US 7 and Cady Road, to the end of US 7 South).
- Minimal flow was observed in the follow pipe segments and these segments were excluded from further evaluation:
    - Middle Road South between Unmarked #1, which is located at the intersection of Middle Road South and Halladay Road, and SMH 12-004.
    - US 7 between SMH 12-004 and SMH 12-005.
    - US 7 between SMH 12-004 and Unmarked #2, which is located at the intersection of US 7 and a private road that connects to Lower Foote Street.
    - US 7 between Unmarked #2 and Unmarked #3, which is located at the intersection of US 7 and Cady Road, to the end of US 7 South.
    - US 7 between Unmarked #3 and end of Cady Road.

4.5 Summary of Areas of Excessive Infiltration

The estimated infiltration flows from the 1st, 2nd, and 3rd night of flow gauging were used to prioritize areas with excessive infiltration. In Table 4.1, these areas are listed by priority with the unit flow and location. Several areas are identified with excessive flows. In some cases, the excessive flow is located at the manholes, but in other locations the flow is contributed from the pipelines, or sewer services. This information can used to determine the need for further evaluation of specific locations and pipe segments under a Phase II investigation. This work could include additional flow gauging, television inspections, or other investigative methods. Any unit flow greater than 1,500 gal/day/in-mile is considered excessive. For new construction, an allowance of 300 gal/day/in-mile is assumed.

Table 4.1
Summary of Areas with Excessive Infiltration

Priority Ranking	Service Areas/ Street	Segment Location	Pipe Length (feet)	Segment Infiltration Flow (gpd)	Unit Flow (gpd/in/mi)
1	PS#9- Weybridge St	09-013 / 09-015	400	16,280	12,158
2	PS#1 – Woodland Park	0701 / 0092	360	10,428	19,118
3	PS#9- Cross Country	09-003 / 09-001W	635	2,975	2,550
4	PS#1- Monroe St. CC	0693 / 0690	590	10,530	13,934
5	PS#12- Middle Rd S	12-001 / Unmarked #1	650	16,250	6,600
6	PS#6- Seminary St. Ext. Cross Country	06-021 / 06-028	1,326	12,782	6,362
7	PS#6- Washington St.	06-040 / 06-039	117	5,798	32,707
8	PS#1- Buttolph Dr.	0659 / 0701	330	7,252	14,504
9	PS#6- Seminary St. Ext.	06-014 / 06-021	85	1,633	12,680
10	PS#1- HS Area	0682 / 0681	385	4,690	8,040
11	PS#6- Colonial Drive S.	06-046 / 06-052	415	4,690	7,459
12	PS#12- RT 7/Cady Rd.	Unnumbered / 12-008	500	3,839	5,067
13	PS#1- HS Area	0682 / 0673	835	6,580	4,657
14	PS#1- Charles Ave	0673 / 0677	960	3,090	2,450
15	PS#12- RT 7/Foote St	12-005 / 12-006	170	2,270	8,813
16	PS#1 – Buttolph Drive	0655 / 0659	230	1,755	5,036
17	PS#12- RT 7/Middle Rd.	12-004 / 12-005	90	1,050	7,700
18	PS#6- Colonial Drive	06-039 / 06-051	830	3,689	2,933
19	PS#12- Middle Rd S	Unmarked #3 / End of US 7	2,520	14,400	2,289
20	PS#1 – Woodland Park	0701 / 0095	890	2,975	2,206
21	PS#6- Peterson Terr.	06-028 / 06-029	540	1,326	2,188
22	PS#6- Seminary St. Ext.	06-014 / 06-024	1,600	4,690	1,935
23	PS#9- Weybridge St	09-011 / 09-022	635	1,458	1,515
		Totals	**15,093**		

SECTION 5

EXCHANGE STREET MANHOLE INSPECTIONS

SECTION 5 EXCHANGE STREET MANHOLE INSPECTIONS

5.1 GENERAL

A day of manhole inspections was performed on December 20, 2012 for the manholes along the Exchange Street trunk sewer from the Cabot connection to the intersection of Seymour Street. The manhole inspections were performed during favorable weather conditions to observe and document the physical condition of the manholes. Kevin Camara of Aldrich + Elliott, PC performed the inspections with the assistance of Paul Lengyel and Dan Rheaume of the Town of Middlebury. A total of fourteen (14) structures were observed. Figure No. 9 in Appendix A shows the location of area and manholes inspected.

5.2 RESULTS OF MANHOLE INSPECTIONS

For each manhole inspected, a "Manhole Observation Sheet" was prepared in the field. Copies of the Manhole Observation Sheets are provided in Appendix F. The results of the manhole inspections are summarized in Table 5.1.

Table 5.1
Results of Manhole Inspections
Exchange Street Trunk Sewer

Manhole ID	Location	Infiltration Observed	Observations
0395	Edge RR/Cross Country	Yes	• Significant bacterial slime growth on walls. • Minor deterioration and spalling of concrete walls. • Minor roots on wall. • 4" of grit in invert. • Infiltration (5 gpm) 8" inlet pipe from west and manhole joint. • Hole in concrete wall.
0398	Edge RR/Cross Country Champlain PS CC	No	• No invert. Cleanout in center of 14" PE pipe does not provide good access for maintenance/cleaning. • Minor deterioration and spalling of concrete walls.

Table 5.1
Results of Manhole Inspections
Exchange Street Trunk Sewer
(Continued)

Manhole ID	Location	Infiltration Observed	Observations
0399	Edge RR/Cross Country	Yes	• 14" PE slip line inlet pipe is pushed in too far which is restricting flow. • 14" PE slip line inlet pipe is pinched to ½ dia. which is also restricting flow. • Significant bacterial slime growth on walls. • Minor deterioration and spalling of concrete walls. • Minor roots on wall. • Grade stakes and rags stuck in outlet pipe. • Infiltration (3 gpm) at inlet pipe connection.
0400	Edge RR/Cross Country US 7 CC	Yes	• 14" PE slip line inlet pipe pushed in too far which is restricting flow. • Significant bacterial slime growth on walls. • Minor deterioration and spalling of concrete walls. • Cracks around MH riser joints. • Minor roots on wall. • Grade stakes and rags stuck in outlet pipe. • Minor infiltration (weeps) at riser joints.
0403	Edge RR/Cross Country	No	• No invert. Cleanout with valve in 14" PE pipe does not provide good access for maintenance/cleaning. Valve not working. • Minor deterioration and spalling of concrete walls.
0405	Edge RR/Cross Country	No	• Frame is pushed over 6" and mortar is cracked. • No invert. Cleanout in center of 14" PE pipe does not provide good access for maintenance/cleaning. • Minor deterioration and spalling of concrete walls.
0406	Edge RR/Cross Country	Yes	• No invert. Cleanout in center of 14" PE pipe does not provide good access for maintenance/cleaning. • Minor deterioration and spalling of concrete walls. • Minor infiltration (weeps) at riser joints.

Table 5.1
Results of Manhole Inspections
Exchange Street Trunk Sewer
(Continued)

Manhole ID	Location	Infiltration Observed	Observations
0407	Edge RR/Cross Country	Yes	• Cut open top portion of 14" PE pipe does not provide good access for maintenance/cleaning. • Minor deterioration and spalling of concrete walls. • Minor infiltration (weeps) at riser joints.
0420	Edge RR/Cross Country	Yes	• 14" PE slip line outlet pipe pushed in too far which is restricting flow. • Minor bacterial slime growth on walls. • Minor deterioration and spalling of concrete walls. • Minor infiltration (weeps) at riser joints.
0421	Edge RR/Cross Country	Yes	• Minor bacterial slime growth on walls. • Minor deterioration and spalling of concrete walls. • Minor root growth on walls. • Significant infiltration (10 gpm) between outer pipe and slip line pipe. • Invert 1/4 full of grit and needs to be cleaned.
0759	Edge RR/Cross Country	No	• Manhole wall covered in bacterial slime growth. • Minor spalling of concrete walls. • Invert 1/2 full of grit and needs to be cleaned.
0759A	Edge RR/Cross Country	Yes	• Manhole wall covered in bacterial slime growth. • Minor spalling of concrete walls. • Significant root growth on walls. • Invert and shelf deteriorated, concrete spalling and significant slime growth. • Infiltration (<1 gpm) at inlet 12" pipe connection.

Table 5.1
Results of Manhole Inspections
Exchange Street Trunk Sewer
(Continued)

Manhole ID	Location	Infiltration Observed	Observations
0780	Edge RR/Cross Country	Yes	• Manhole wall covered in bacterial slime growth. • Invert deteriorated, concrete spalling and significant slime growth. • Minor infiltration (weeping) at inlet and outlet pipe connections and base/riser joint.
0780A	Edge RR/Cross Country	Yes	• Manhole wall covered in bacterial slime growth. • Invert deteriorated, concrete spalling and significant slime growth. • Hole in manhole wall. • Infiltration (5 gpm) through hole in wall and under frame

SECTION 6

MAIN PUMP STATION CAPACITY EVALUATION

SECTION 6 MAIN PUMP STATION CAPACITY EVALUATION

6.1 GENERAL

The Main Pump Station is located at the end of Lucius Shaw Lane at the site of the former WWTF. This pump station conveys the wastewater through a forcemain to the wastewater treatment facility (WWTF) located at the end of Industrial Avenue for treatment prior to discharge to the Otter Creek.

In 2010 the Town completed an upgrade to the Main Pump Station which added an expanded wet well and grit removal facilities to reduce overflows at the station to be in compliance with the State of Vermont CSO Control Policy and to reduce the amount of grit accumulating in the forcemain.

The pumps were originally designed to discharge up to 6.2 mgd with two (2) pumps running. The operators indicated that the 6.2 mgd was achieved during the first few years of operations, but a steady decrease was observed after. This section studies the actual capacity of the pumps and alternatives to regain the existing capacity.

The forcemain is approximately 11,772 feet long and consists of 172 l.f. of 16" DI, 600 l.f. of 18" DI, and 11,000 l.f. of 18" PVC pipe. There are six (6) high points with air release/vacuum valves. There are five (5) low points which have blow off valves.

The pumps are variable speed 150 hp vertical centrifugal pumps. Each pump is designed for 2,250 gpm at 157 ft TDH. There is a flow metering manhole near the pump station with a magnetic flow meter. There are two (2) wet wells. One (1) with 15,000 gallon capacity and the other with 180,000 gallons of capacity.

6.2 PUMP CAPACITY TESTING

6.2.1 1st Round - August 29, 2012

Pump drawdown tests were performed at the Middlebury Main Pump Station on August 29, 2012 to document the pumping capacity of the existing pumps. Kevin Camara from A+E and Bob Wells and Jerry Skira from the Town were on-site to monitor and document the results of the pump test.

The actual pumping rates were field verified for each individual pump, two (2) pumps running with the flow meter manhole bypassed, and all three (3) pumps running. The pump(s) were each run at high speed (60 hz) to estimate the maximum capacity. The original wet well along with the surcharging in two (2) manholes and the 24" pipeline to the new wet well were used for the drawdown while incoming flow was stored in the new wet well. This test was performed so that the incoming flow did not impact the drawdown test results. Table 6.1 provides a summary of the testing results.

Table 6.1
Pump Drawdown Testing Result Summary

Description	Drawdown Result		Flow Meter Reading		Flowmeter Percent Error
	GPM	MGD	GPM	MGD	
Pump 1- High Speed	2,687	3.87	2,166	3.12	-20.9%
Pump 2- High Speed	2,544	3.66	2,126	3.06	-16.4%
Pump 3- High Speed	2,516	3.62	2,122	3.06	-15.6%
Pump 1 & 2- High Speed	3,551	5.11	3,000	4.32	-15.5%
Pump 1 & 3- High Speed	3,564	5.13	3,060	4.41	-14.1%
Pump 1 & 3- High Speed w/ Flow Meter Manhole Bypassed	3,735	5.38	-	-	-
Pump 1, 2 & 3- High Speed	3,918	5.64	3,426	4.93	-12.5%

Notes:
1. With the flow metering manhole bypassed, there is no flow meter reading available.

Sketches of the wet well are provided in Appendix G. Wet well drawdown volume calculations are provided in Appendix H. Pump Capacity calculations from the 1st round of drawdown testing are provided in Appendix I.

6.2.2 2nd Round- October 11, 2012

A second round of pump drawdown and forcemain testing was performed at the Middlebury Main Pump Station on October 11, 2012 to document the operating pressures and evaluate the flows compared to the original pump curves. Kevin Camara from A+E and Bob Wells and Jerry Skira from the Town were on-site to monitor and document the results of the pump test.

The static pressure of the forcemain was measured to be 30 psi (69 feet). With one (1) pump running at high speed, the drawdown calculated flow rate was 2,479 gpm and the system pressure was measured to be 55 psi (127 feet). The magnetic flow meter was reading 2,122 gpm which was off by approximately -14.4%. When plotting the calculated flow rate and system pressure on the pump curve, the pump appears to be pumping well below what it should be. As shown on the attached pump curve, at a Total Dynamic Head (TDH) of 127 feet, the pump should be pumping approximately 2,800 gpd. See Appendix J for the 2nd round pump drawdown calculations and the pump system curve.

6.2.3 Forcemain Headloss

The TDH for the system was estimated based on the measured static pressure and the calculated friction head loss. The friction head loss was calculated based on the measured flow rate, pipe diameters, pipe lengths, losses through fittings, and the estimated C factor for the types of pipe installed and current age. The expected C factor for twelve (12) year old pipe is 140 for PVC and 120 for ductile iron.

The estimated TDH based on calculated conditions and estimated C factors is 105 feet for 2,479 gpm. The calculated TDH is lower than the actual measured system pressure of 127 feet. Therefore, there is it is possible that something in the forcemain is causing a higher system

pressure. We then lowered the C Factor to match the measured system pressure of 127 feet; the resulting C factors are 111 for PVC and 91 for ductile iron. See Appendix K for forcemain headloss and system curve calculations.

These are very low numbers for this age and type of pipe which suggests that accumulated grit in the forcemain may be causing the higher system pressure. It was recommended that the Town pursue pricing for pigging of the forcemain.

6.3 FORCEMAIN PIGGING

Force main cleaning typically includes running a manufactured polypropylene "pigging" device through the line and long force mains are typically equipped with "pig" insertion and retrieval stations. The Main Pump Station forcemain does not have a pig insertion or retrieval station.

The Town contacted Richard Berthiaume, General Manager of Eastern Pipe Services to review the Town's Main Pump Station and forcemain and provide technical recommendations and budgetary pricing for pigging the forcemain using standard poly pigging operations. A site visit was conducted on January 16, 2013 to look at the pump station, forcemain access points and the receiving facilities at the WWTF.

It was determined that the several existing conditions limit the ability to pig the forcemain using standard poly pig techniques without the high likelihood that the pig would get stuck or that there would be enough storage capacity for pigging operations. These limitations include:

- No pig insertion or retrieval stations.
- Two (2) 90° bends at the WWTF.
- Two (2) wyes in the forcemain with straight runs against closed valves.
- Change in pipe size from 16" to 18".
- Volume of fluid needed for pigging vs. the volume of wet well storage available before overflow.

It was determined that pigging the forcemain by standard poly pig techniques was not viable for the Town.

The Town then contacted Utility Service from Bow, NH to provide technical recommendations and pricing for ice pigging of the forcemain. Ice pigging is an innovative/alternative method of pigging forcemains. Ice pigging combines the operational advantages of flushing with the cleaning impact of soft pigging. The Ice Pig is a semi-solid that is pumped like a liquid and flows through changes in diameter, bends and fittings without blockage. Ice pigging has a minimum impact on operations. The ice pig is simply pumped into the system and either melts in the pipe or is recovered at the WWTF without excavation.

A site visit was conducted with Scott Kelley of Utility Service on February 8, 2013. A second site visit was conducted with Paul Treloar, Operations Manager of Utility Service on March 20, 2013. On March 26, 2013, Utility Service provided the Town with a cost of $108,000 for pigging of the

forcemain using the ice pigging technology. On May 26, 2013, Utility Service provided the Town with per day cost for ice pigging which is $36,000 for the 1st three (3) days and $12,000 per day if operations are conducted or $6,000 per day if cancelled early. See Appendix L for the cost proposal and technical information for ice pigging.

SECTION 7

RECOMMENDED PLAN

SECTION 7 RECOMMENDED PLAN

7.1 GENERAL

This section includes the recommendations for:

- Phase II Sewer System evaluation study areas
- Exchange Street trunk sewer manhole improvements
- Pigging of the Main Pump Station Forcemain

7.2 PHASE II SEWER SYSTEM EVALUATION STUDY AREAS

The results of the night-time flow gauging and Exchange Street trunk sewer manhole inspection were used to develop the recommendations for the Middlebury wastewater collection system to reduce infiltration/inflow. This section provides information on the recommended approach including:

- Phase II Sewer System Evaluation Study including areas of recommended internal TV inspection and manhole inspections.
- Areas of recommended manhole rehabilitation.

It is recommended that a Phase II Sewer System Evaluation be performed on the pipeline segments which were identified as contributing excessive infiltration. A summary of these pipeline segments is provided in priority on Table 7.1.

Refer to the following figures for maps of the areas recommended for Phase II- Sewer System Evaluation:

- High School Pump Station (PS #1)- Figure No. 14
- Seminary Pump Station (PS #6)- Figure No. 15
- Weybridge Pump Station (PS #9)- Figure No. 16
- Halladay Pump Station (PS #12)- Figure No. 17

The Phase II evaluation includes light flushing and internal pipeline television inspection along with manhole inspections of all manholes along those segments. Recommending specific improvements at this time is difficult and not cost effective without gathering additional information and internally inspecting the pipelines in the areas of excessive infiltration. Complete pipe replacement in these areas is not always cost effective and may not be necessary in some pipe segments. Other types of pipeline rehabilitation methods used can be as effective in correcting the infiltration problems. Viewing the interior of each pipeline allows observation and analysis of each pipe joint to better identify the problem areas.

Flushing and television inspection is recommended on the pipelines which are contributing excessive infiltration listed in priority as shown in Table 7.1. There is approximately 15,500 lineal feet of gravity sewerline recommended for flushing and TV inspection. Flushing of the pipeline is

recommended prior to the TV inspection because clean pipelines greatly improve the quality of the video and the accuracy of the information. The light flushing and TV inspection typically costs approximately $2.00 per linear foot of pipeline which would make the total cost of flushing and TV inspection approximately $31,000.

Table 7.1
Areas Recommended for Phase II- Sewer System Evaluation Summary of Areas with Excessive Infiltration

Priority Ranking	Service Areas/ Street	Segment Location	Pipe Length (feet)
1	PS#9- Weybridge St	09-013 / 09-015	400
2	PS#1 – Woodland Park	0701 / 0092	360
3	PS#9- Cross Country	09-003 / 09-001W	635
4	PS#1- Monroe St. CC	0693 / 0690	590
5	PS#12- Middle Rd S	12-001 / Unmarked #1	650
6	PS#6- Seminary St. Ext. CC	06-021 / 06-028	1,326
7	PS#6- Washington St.	06-040 / 06-039	117
8	PS#1- Buttolph Dr.	0659 / 0701	330
9	PS#6- Seminary St. Ext.	06-014 / 06-021	85
10	PS#1- HS Area	0682 / 0681	385
11	PS#6- Colonial Drive S.	06-046 / 06-052	415
12	PS#12- RT 7/Cady Rd.	Unnumbered / 12-008	500
13	PS#1- HS Area	0682 / 0673	835
14	PS#1- Charles Ave	0673 / 0677	960
15	PS#12- RT 7/Foote St	12-005 / 12-006	170
16	PS#1 – Buttolph Drive	0655 / 0659	230
17	PS#12- RT 7/Middle Rd.	12-004 / 12-005	90
18	PS#6- Colonial Drive	06-039 / 06-051	830
19	PS#12- Middle Rd S	Unmarked #3 / End of US 7	2,520
20	PS#1 – Woodland Park	0701 / 0095	890
21	PS#6- Peterson Terr.	06-028 / 06-029	540
22	PS#6- Seminary St. Ext.	06-014 / 06-024	1,600
23	PS#9- Weybridge St	09-011 / 09-022	635
		Totals	**15,093**

After completion of the TV inspection, the logs and tapes can be reviewed to perform a detailed assessment of the problem areas. Various improvements can then be evaluated for the deficient areas to perform a cost effective analysis of different types of repair and rehabilitation methods. Costs for the recommended improvements can then be provided.

After manhole inspections are completed of all the manholes in the areas of excessive infiltration listed in Table 7.1, a complete list of manhole deficiencies, recommended rehabilitation and costs can be performed.

7.3 EXCHANGE STREET TRUNK SEWER MANHOLE IMPROVEMENTS

Specific improvements for the Exchange Street trunk sewer manholes which were inspected are summarized in Table 7.2.

Table 7.2
Recommended Manhole Improvements
Exchange Street Trunk Sewer

Priority	Manhole No.	Location	Recommended Repairs
1	0421	Cross Country-Seymour Street/Railroad	• Chemical grout between outer pipe and slip line pipe to remove infiltration. • Remove root growth on walls. • Remove excessive grit from invert.
2	0780A	Edge RR	• Chemical grout hole in wall to remove infiltration. • Remove, remortar and reset frame/cover to remove infiltration.
3	0395	Edge RR	• Chemical grout 8" inlet pipe and manhole joint to remove infiltration • Chemical grout hole in wall to remove infiltration. • Remove root growth on walls.
4	0399	Edge RR	• Cut back protruding 14" PE inlet pipe causing restricted flow. • Chemical grout between outer pipe and slip line pipe to remove infiltration. • Remove root growth on walls. • Remove grade stakes and rags stuck in outlet pipe.
5	0400	Edge RR	• Cut back protruding 14" PE inlet pipe causing restricted flow.
6	0420	Edge RR	• Cut back protruding 14" PE outlet pipe causing restricted flow.

Table 7.2
Recommended Manhole Improvements
Exchange Street Trunk Sewer
(Continued)

Priority	Manhole No.	Location	Recommended Repairs
7	0405	Edge RR	• Remove, remortar and reset frame/cover • Remove straight through 14" PE pipe and cleanout. Provide an invert for proper maintenance.
8	0403	Edge RR	• Remove straight through 14" PE pipe and cleanout. Provide an invert for proper maintenance.
9	0406	Edge RR	• Remove straight through 14" PE pipe and cleanout. Provide an invert for proper maintenance.
10	0407	Edge RR	• Remove partially cut open straight through 14" PE pipe and cleanout. Provide an invert for proper maintenance.
11	0398	Edge RR	• Remove straight through 14" PE pipe and cleanout. Provide an invert for proper maintenance.
12	0759A	Cross Country-RR to Cabot	• Chemical grout 12" inlet pipe to remove infiltration. • Remove root growth on walls.
13	0759	Edge RR	• Remove excessive grit from invert.

7.4 MAIN PUMPING STATION PUMPING CAPACITY

It is recommended that the Town clean 11,772 l.f. of forcemain serving the Main Pump Station by ice pigging. The cost of ice pigging is approximately $180,000.

APPENDICES

APPENDIX A

FIGURES

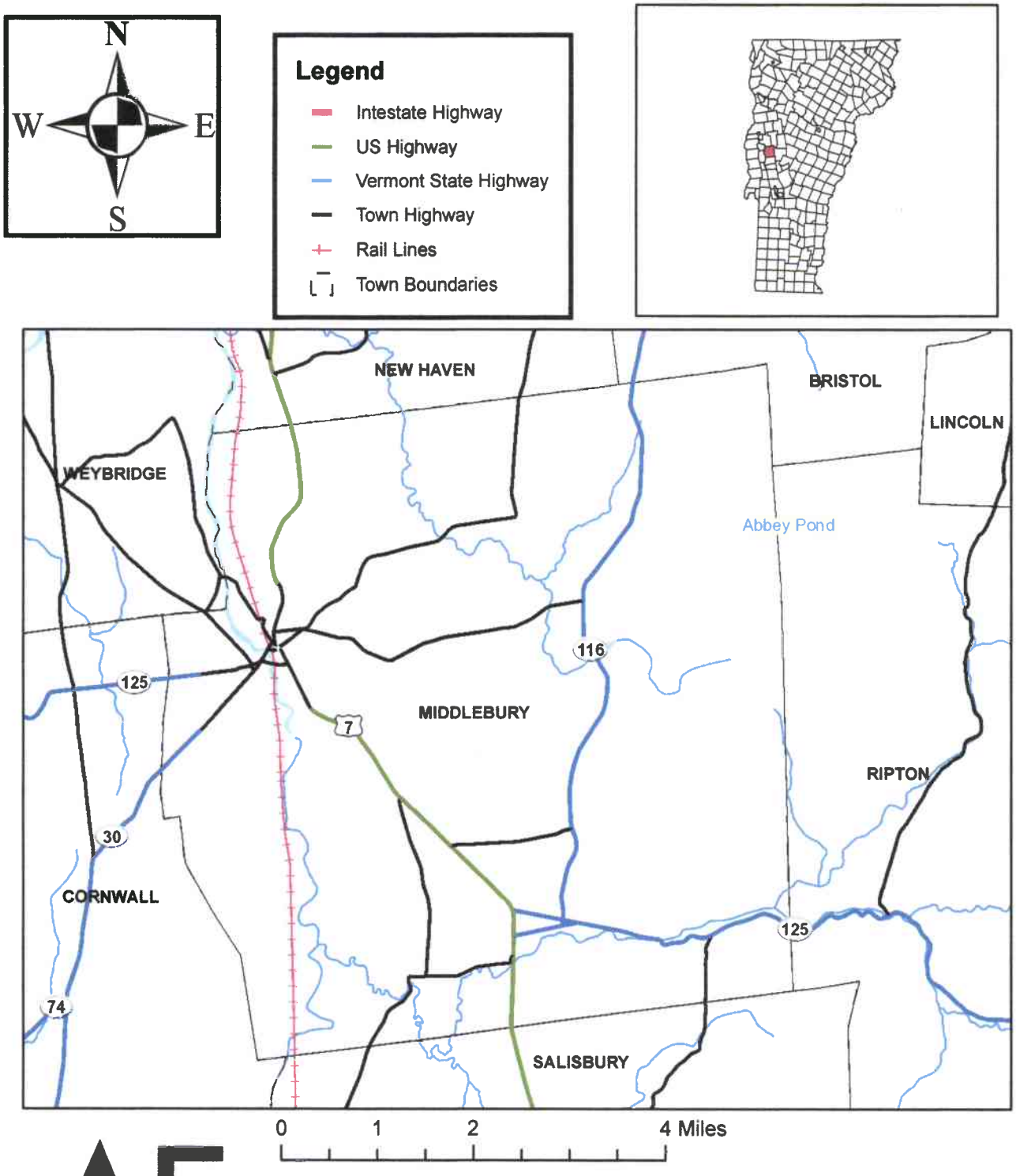

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FIGURE NO. 1
LOCATION MAP
SEWER SYSTEM EVALUATION STUDY- PHASE I
TOWN OF MIDDLEBURY
MIDDLEBURY, VERMONT

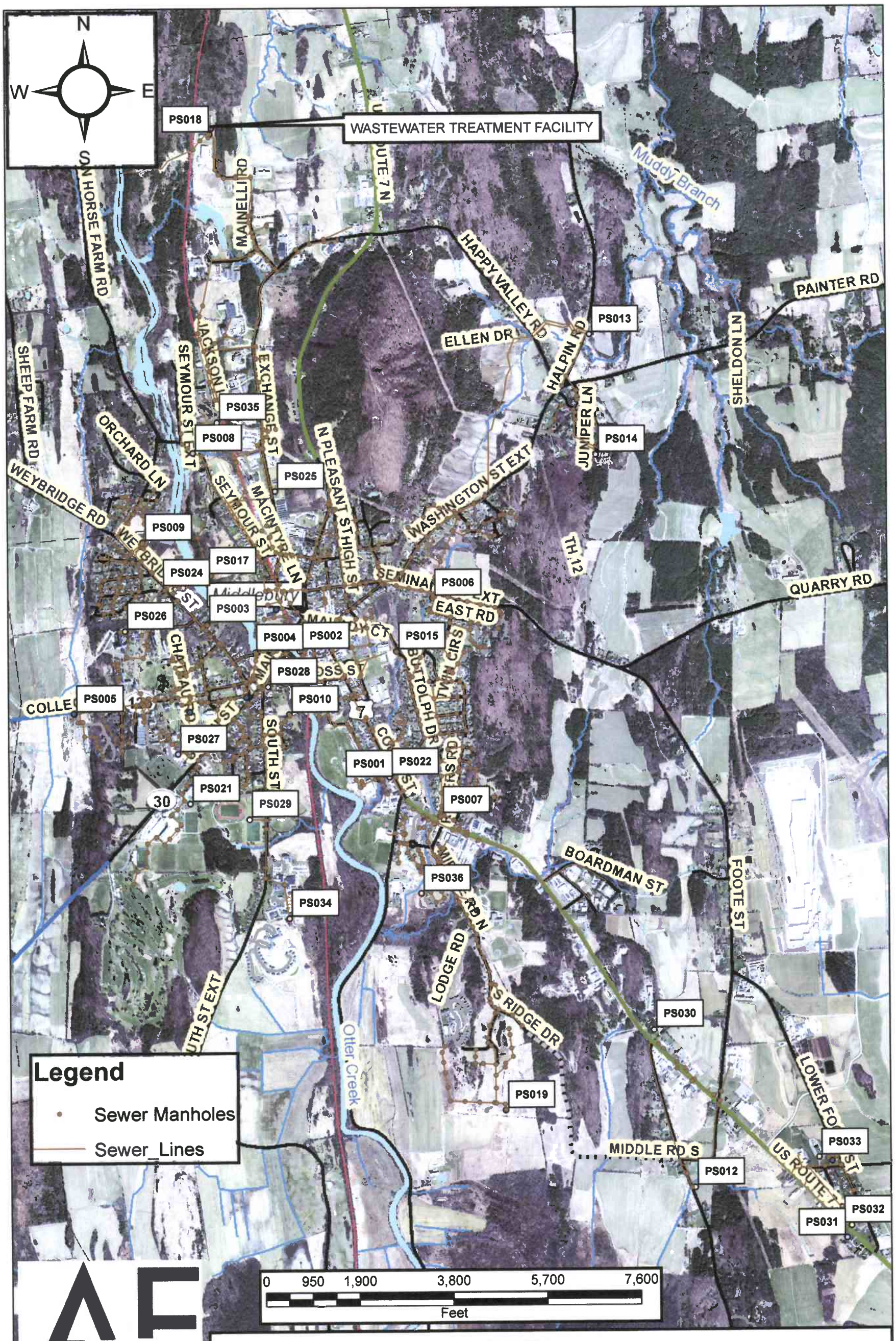

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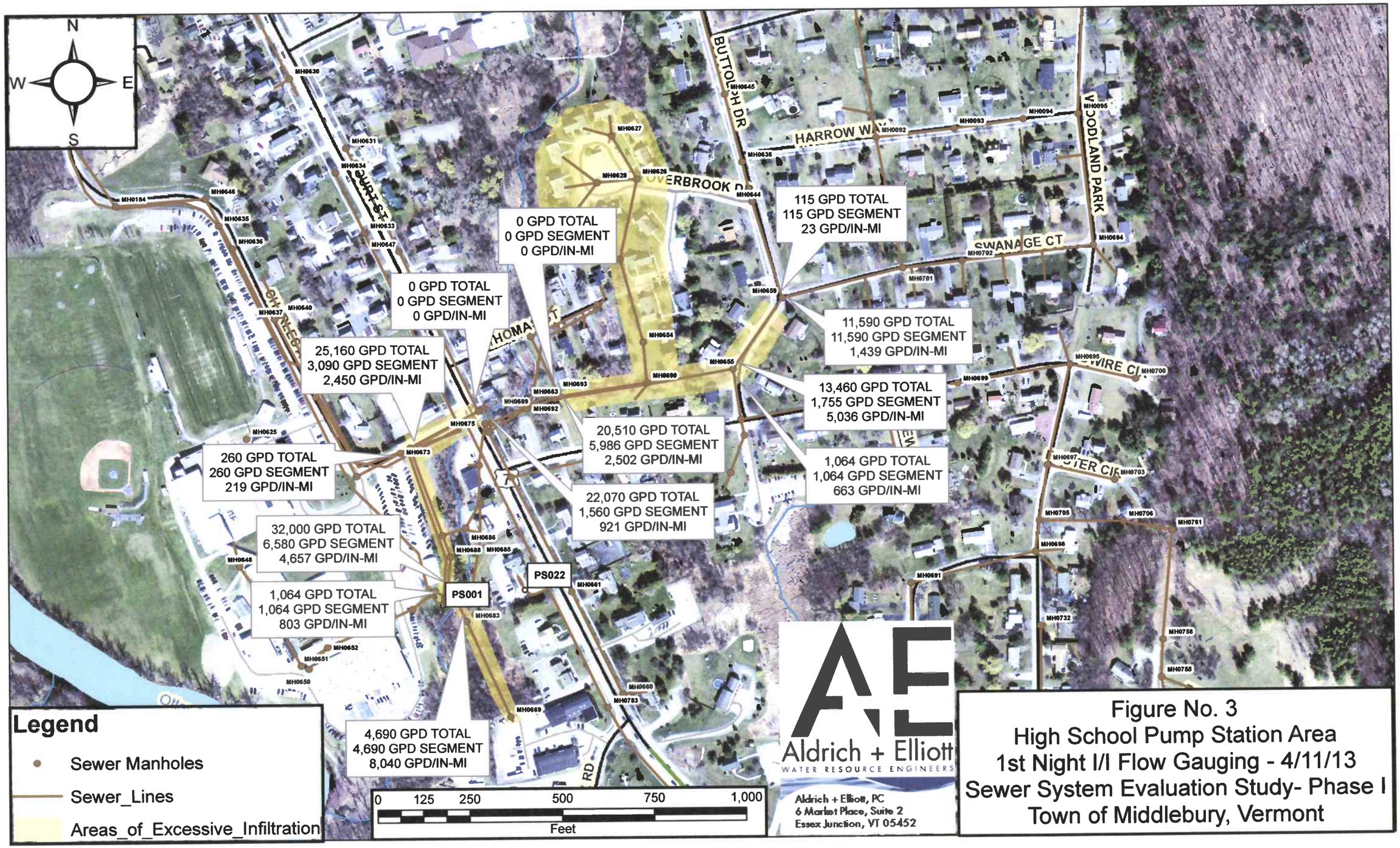
FIGURE NO. 2
SEWER SYSTEM MAP
SEWER SYSTEM EVALUATION STUDY-PHASE I
TOWN OF MIDDLEBURY, VERMONT



Legend

- Sewer Manholes
- Sewer_Lines
- Areas_of_Excessive_Infiltration

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Figure No. 3
High School Pump Station Area
1st Night I/I Flow Gauging - 4/11/13
Sewer System Evaluation Study- Phase I
Town of Middlebury, Vermont

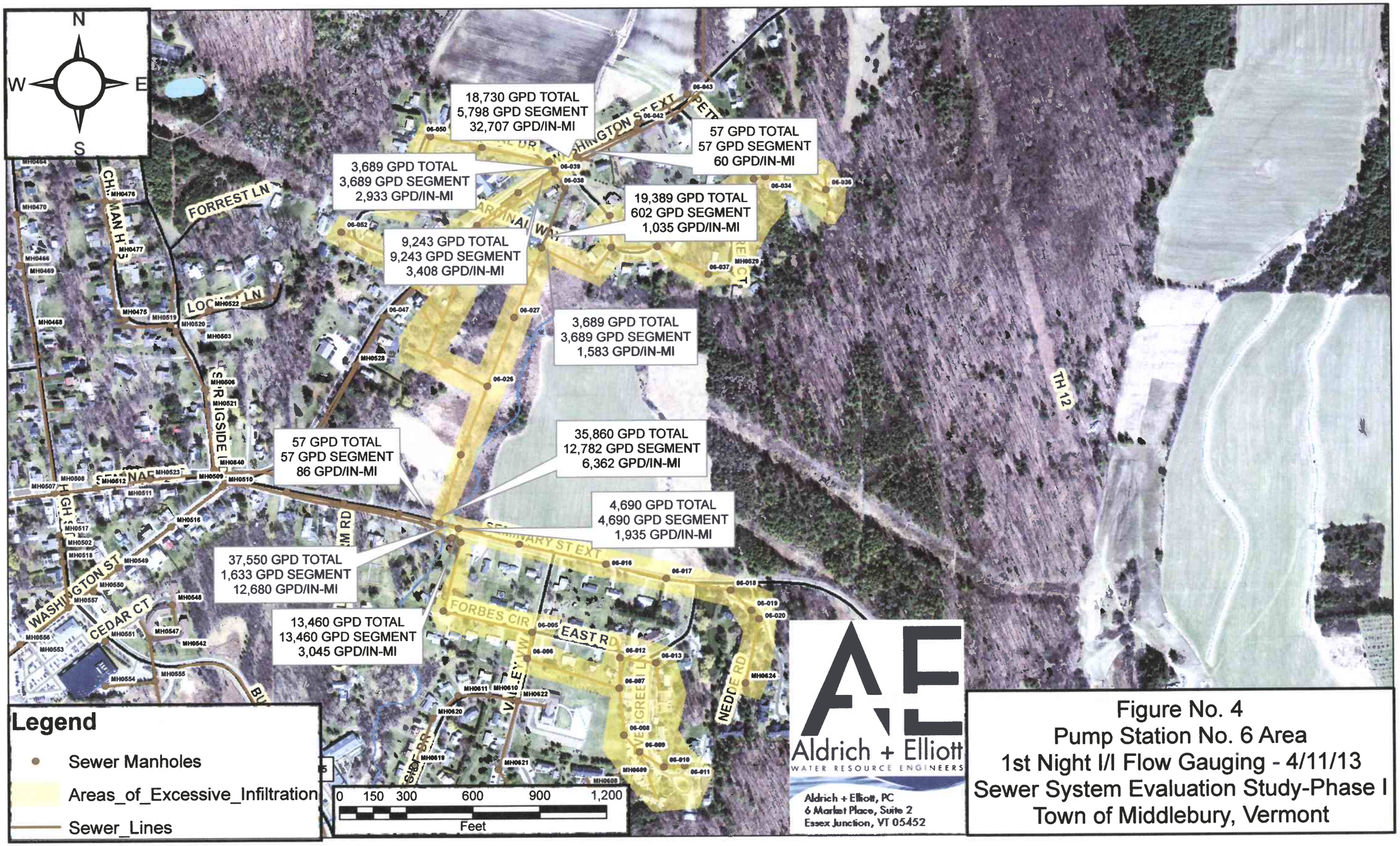

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Figure No. 4
Pump Station No. 6 Area
1st Night I/I Flow Gauging - 4/11/13
Sewer System Evaluation Study-Phase I
Town of Middlebury, Vermont

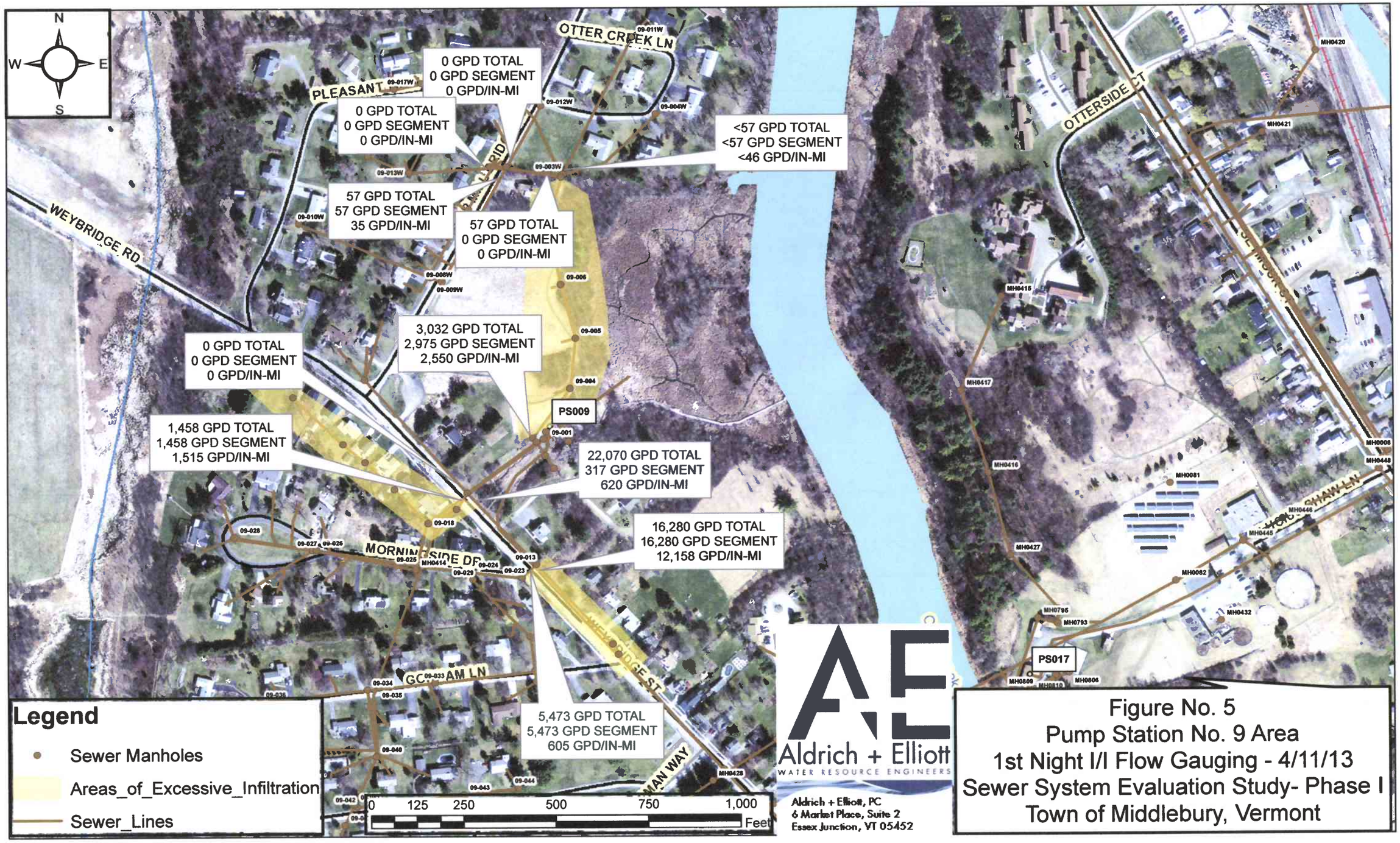

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Figure No. 5
Pump Station No. 9 Area
1st Night I/I Flow Gauging - 4/11/13
Sewer System Evaluation Study- Phase I
Town of Middlebury, Vermont

N
W
E
S

PS030

0 GPD TOTAL
0 GPD SEGMENT
0 GPD/IN-MI

FOOTE ST

DOREY

29,440 GPD TOTAL
24,038 GPD SEGMENT
3,526 GPD/IN-MI

LOWER FOOTE ST

2,270 GPD TOTAL
2,270 GPD SEGMENT
8,813 GPD/IN-MI

4,690 GPD TOTAL
3,839 GPD SEGMENT
5,067 GPD/IN-MI

3,320 GPD TOTAL
1,050 GPD SEGMENT
7,700 GPD/IN-MI

57 GPD TOTAL
57 GPD SEGMENT
13 GPD/IN-MI

MIDDLE RD S

CADY RD

12-003
12-002

12-008

1,064GPD TOTAL
1,064 GPD SEGMENT
405 GPD/IN-MI

PS012

46,610 GPD TOTAL
13,850 GPD SEGMENT
1,814 GPD/IN-MI

12-001

ALLEY RD

442 GPD TOTAL
442 GPD SEGMENT
89 GPD/IN-MI

MH0768

MH0767

PS032

MH0766

PS031

Legend

- Sewer Manholes
- Areas_of_Excessive_Infiltration
- Sewer_Lines

0 312.5 625 1,250 1,875 2,500
Feet

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Figure No. 6
Pump Station No. 12
1st Night I/I Flow Gauging- 4/11/13
Sewer System Evaluation Study- Phase I
Town of Middlebury, Vermont

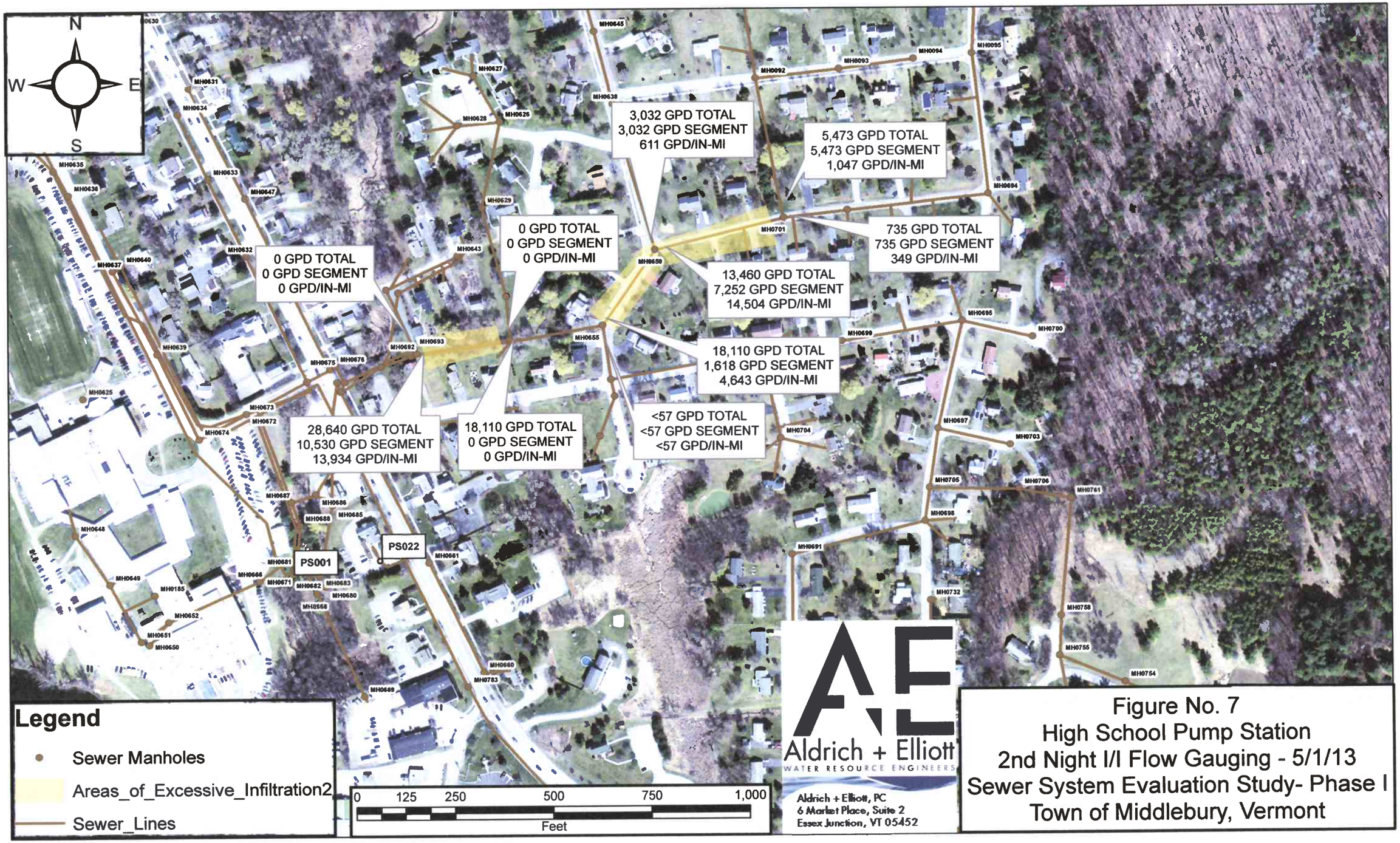

Figure No. 7
High School Pump Station
2nd Night I/I Flow Gauging - 5/1/13
Sewer System Evaluation Study- Phase I
Town of Middlebury, Vermont

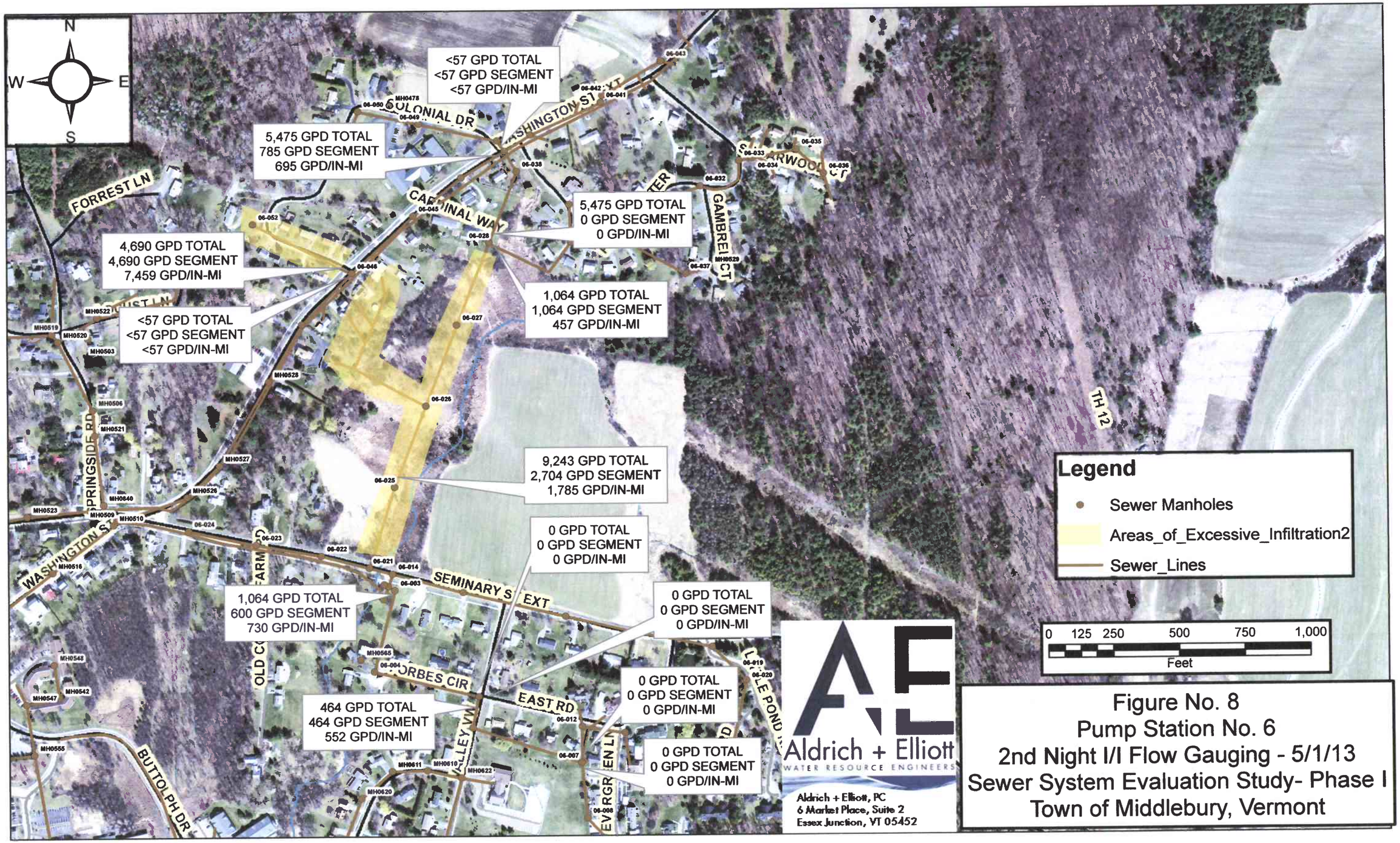

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Figure No. 8
Pump Station No. 6
2nd Night I/I Flow Gauging - 5/1/13
Sewer System Evaluation Study- Phase I
Town of Middlebury, Vermont

Figure No. 9
High School Pump Station
3rd Night I/I Flow Gauging - 6/6/13
Sewer System Evaluation Study- Phase I
Town of Middlebury, Vermont

N
W E
S

PS015

3,032 GPD TOTAL
3,032 GPD SEGMENT
1,220 GPD/IN-MI

<57 GPD TOTAL
<57 GPD SEGMENT
<57 GPD/IN-MI

<57 GPD TOTAL
<57 GPD SEGMENT
<114 GPD/IN-MI

13,460 GPD TOTAL
10,428 GPD SEGMENT
19,118 GPD/IN-MI

3,032 GPD TOTAL
2,975 GPD SEGMENT
2,206 GPD/IN-MI

Legend

- Sewer Manholes
- Areas_of_Excessive_Infiltration
- Sewer_Lines

0 150 300 600 900 1,200
Feet

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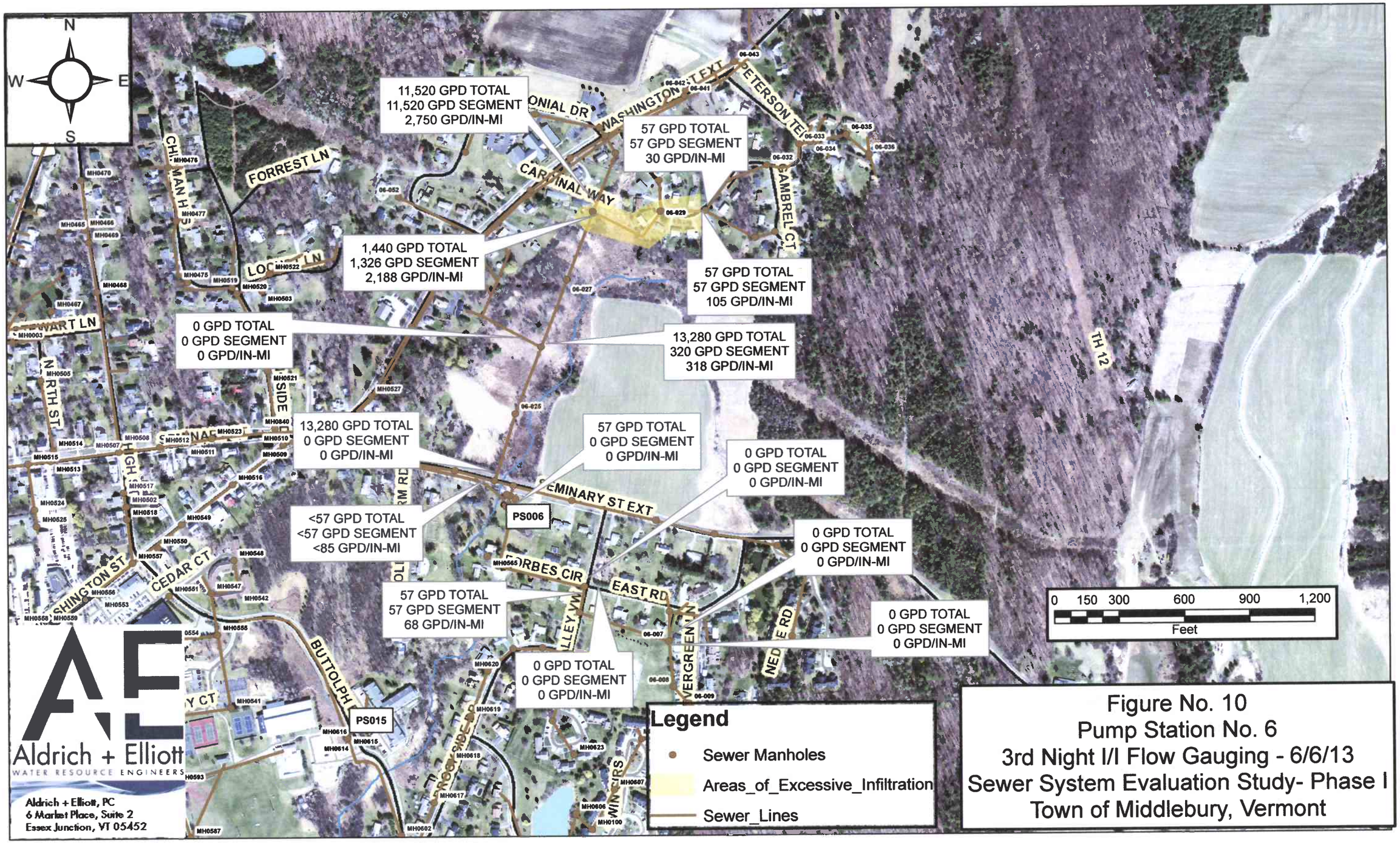

Figure No. 10
Pump Station No. 6
3rd Night I/I Flow Gauging - 6/6/13
Sewer System Evaluation Study- Phase I
Town of Middlebury, Vermont

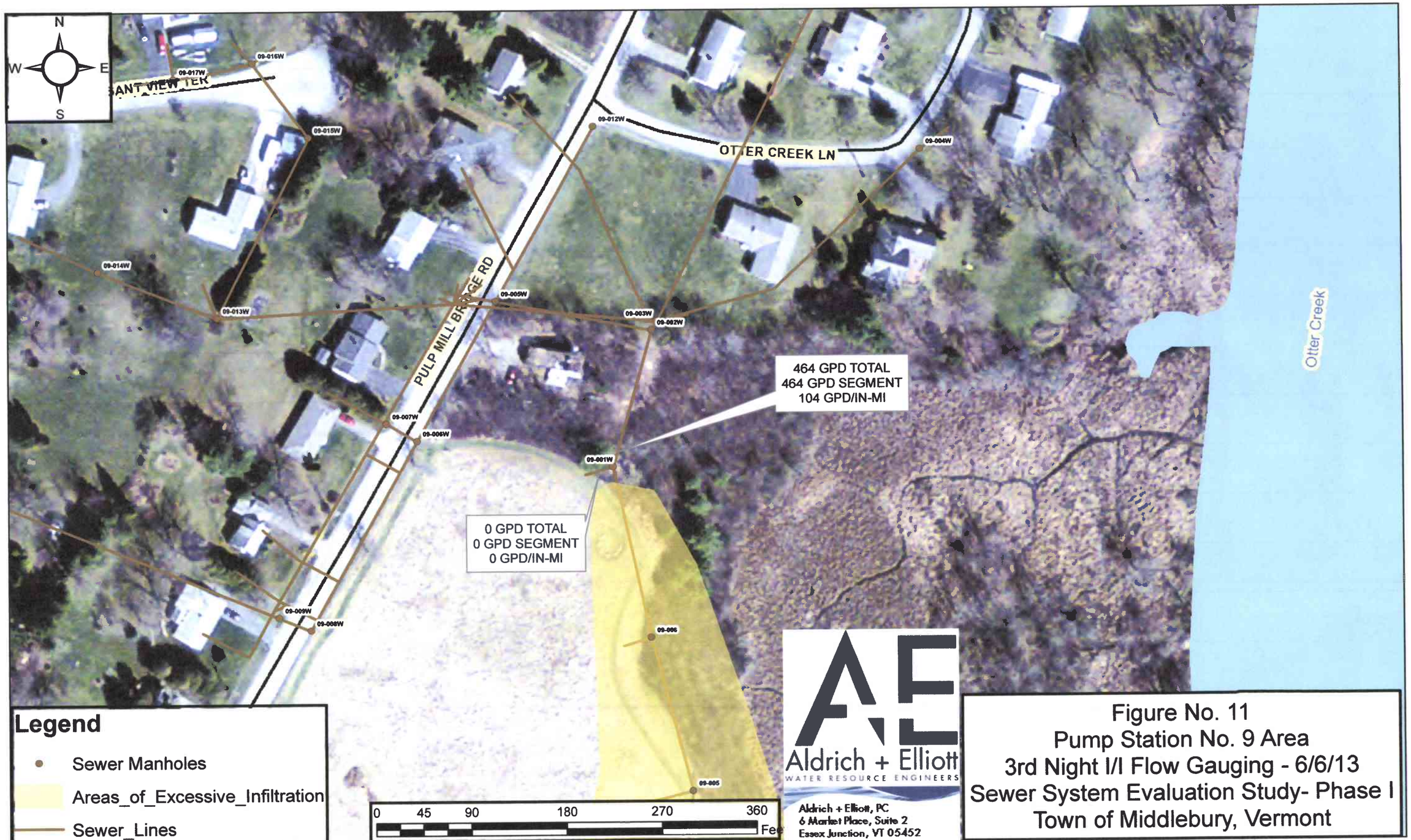

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Figure No. 11
Pump Station No. 9 Area
3rd Night I/I Flow Gauging - 6/6/13
Sewer System Evaluation Study- Phase I
Town of Middlebury, Vermont

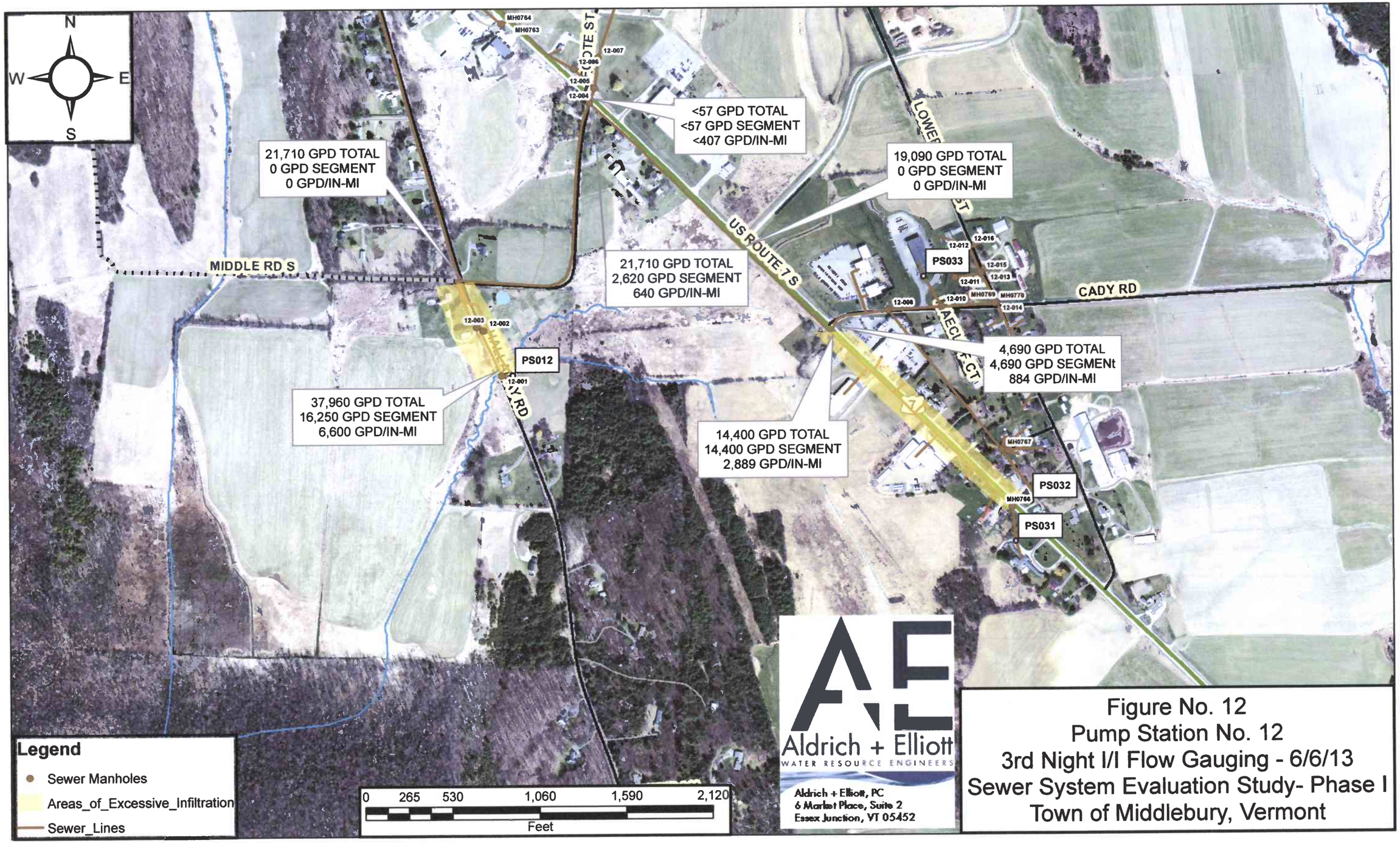

Figure No. 12
Pump Station No. 12
3rd Night I/I Flow Gauging - 6/6/13
Sewer System Evaluation Study- Phase I
Town of Middlebury, Vermont

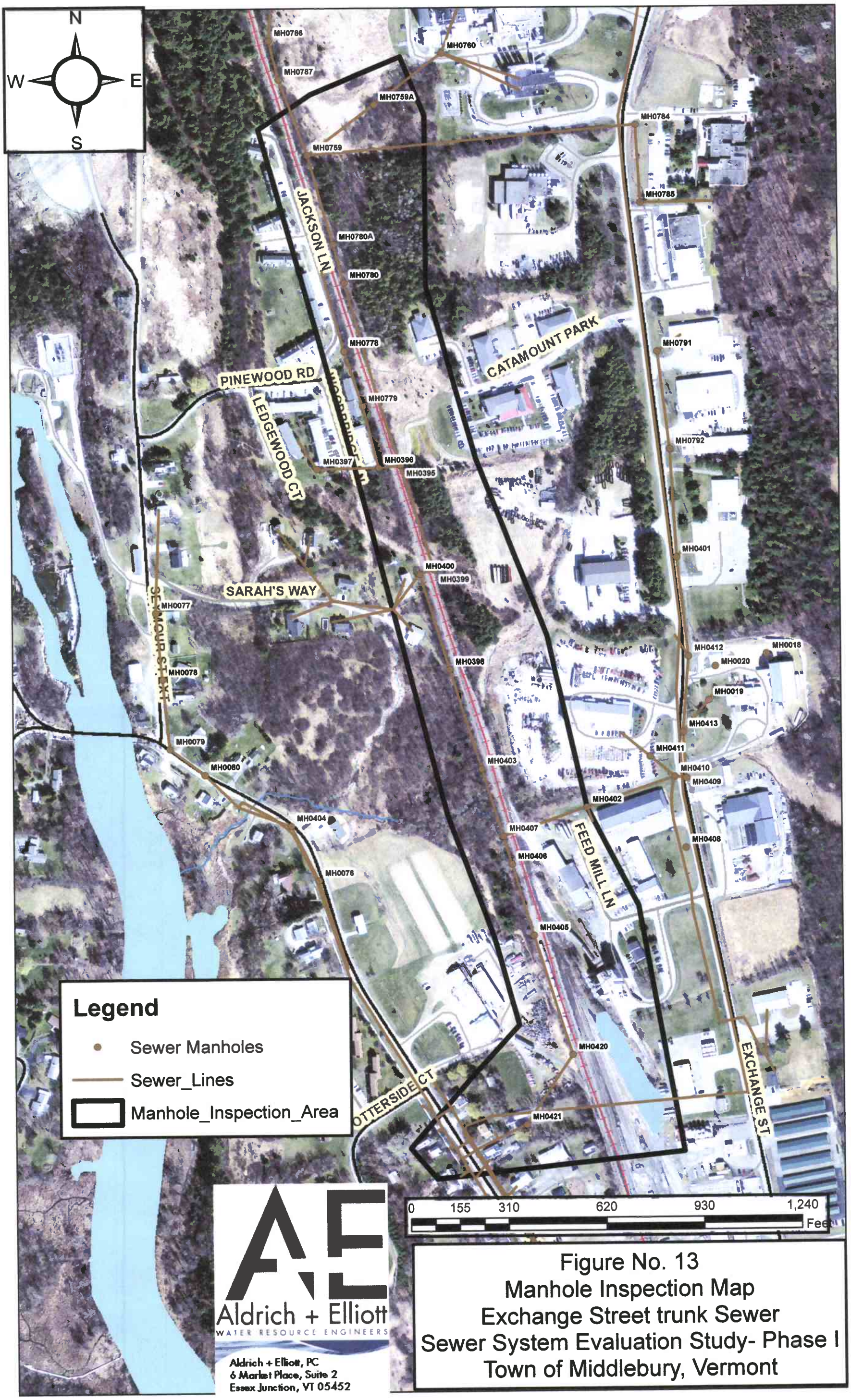

Figure No. 13
Manhole Inspection Map
Exchange Street trunk Sewer
Sewer System Evaluation Study- Phase I
Town of Middlebury, Vermont

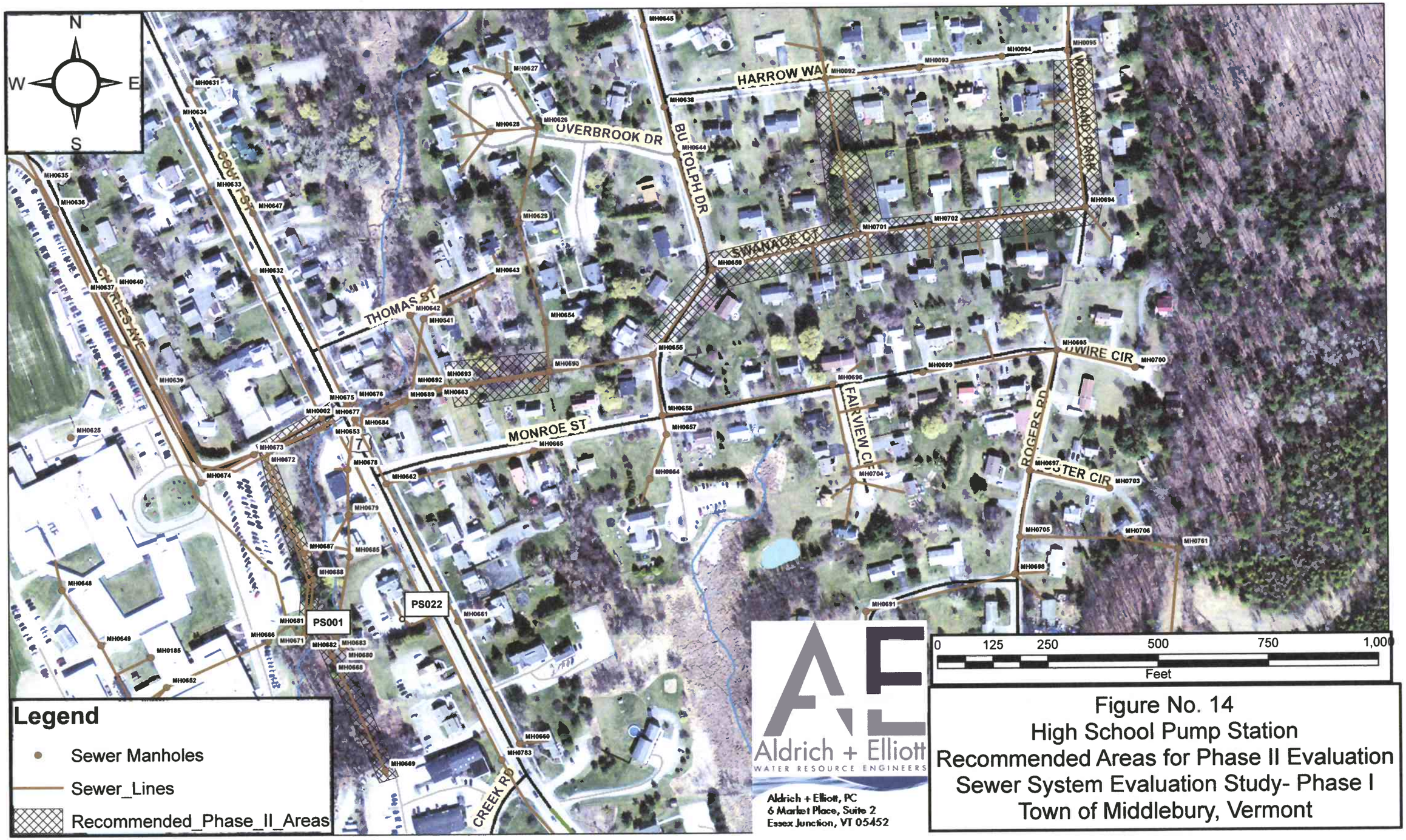

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Figure No. 14
High School Pump Station
Recommended Areas for Phase II Evaluation
Sewer System Evaluation Study- Phase I
Town of Middlebury, Vermont

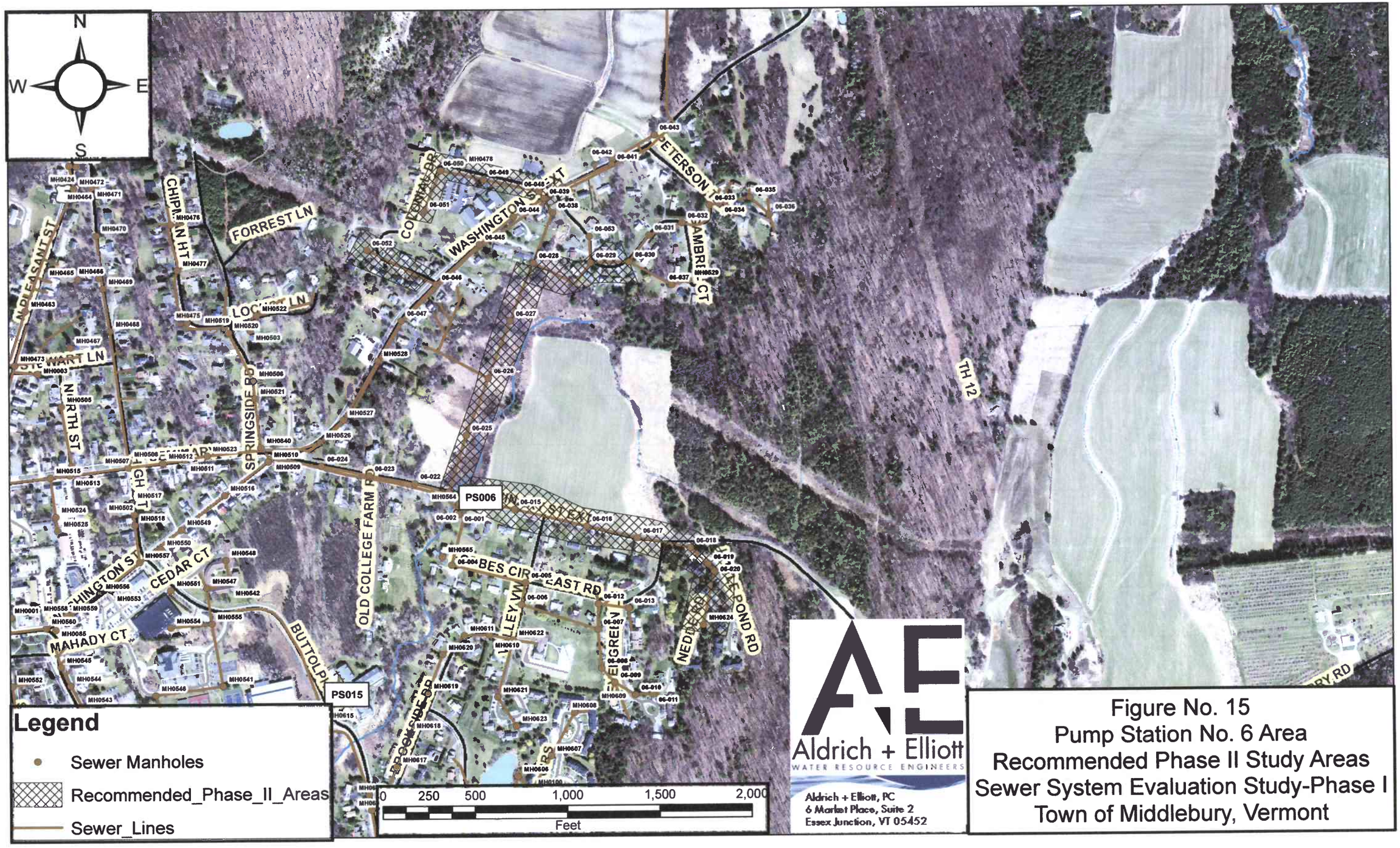

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Figure No. 15
Pump Station No. 6 Area
Recommended Phase II Study Areas
Sewer System Evaluation Study-Phase I
Town of Middlebury, Vermont

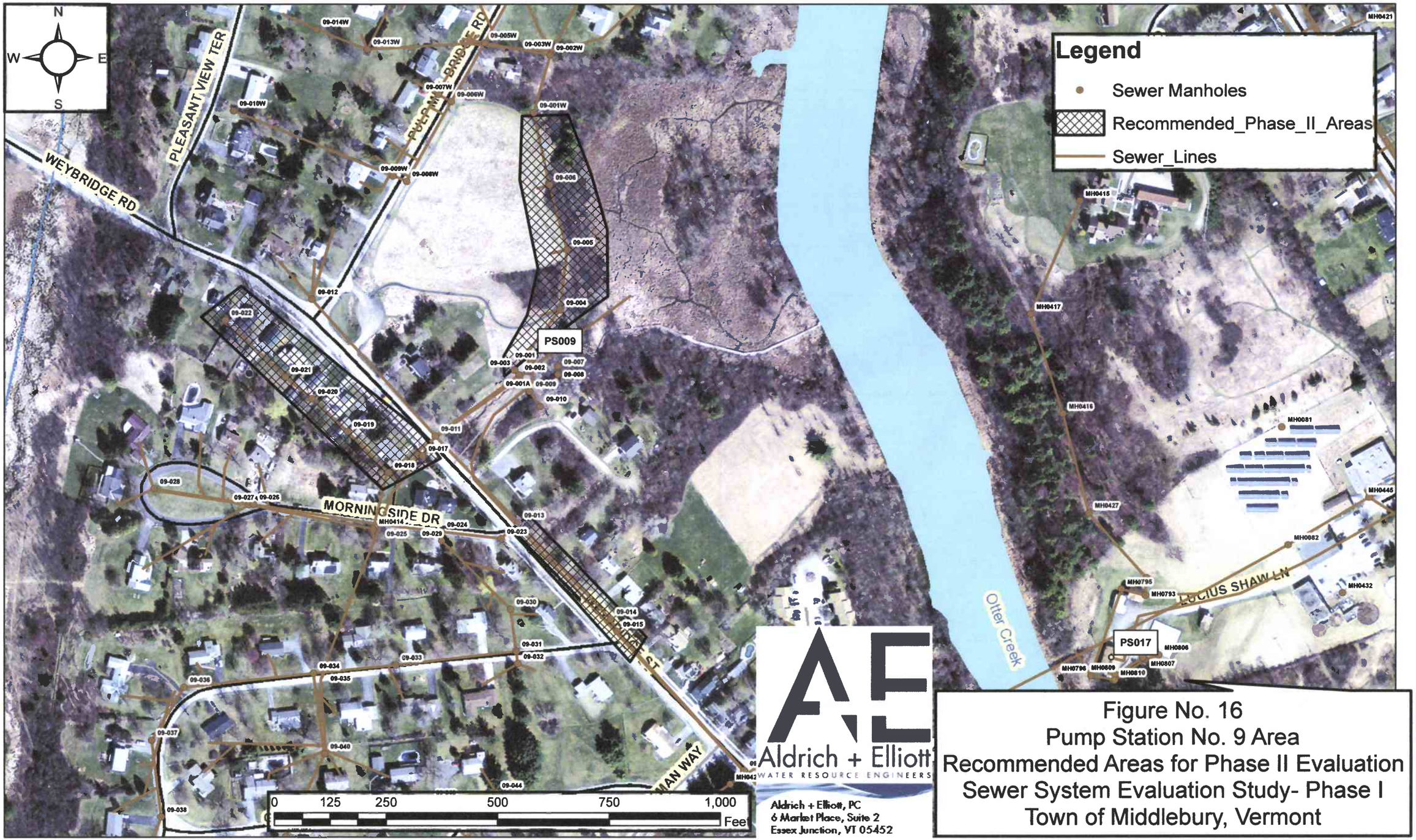

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Figure No. 16
Pump Station No. 9 Area
Recommended Areas for Phase II Evaluation
Sewer System Evaluation Study- Phase I
Town of Middlebury, Vermont

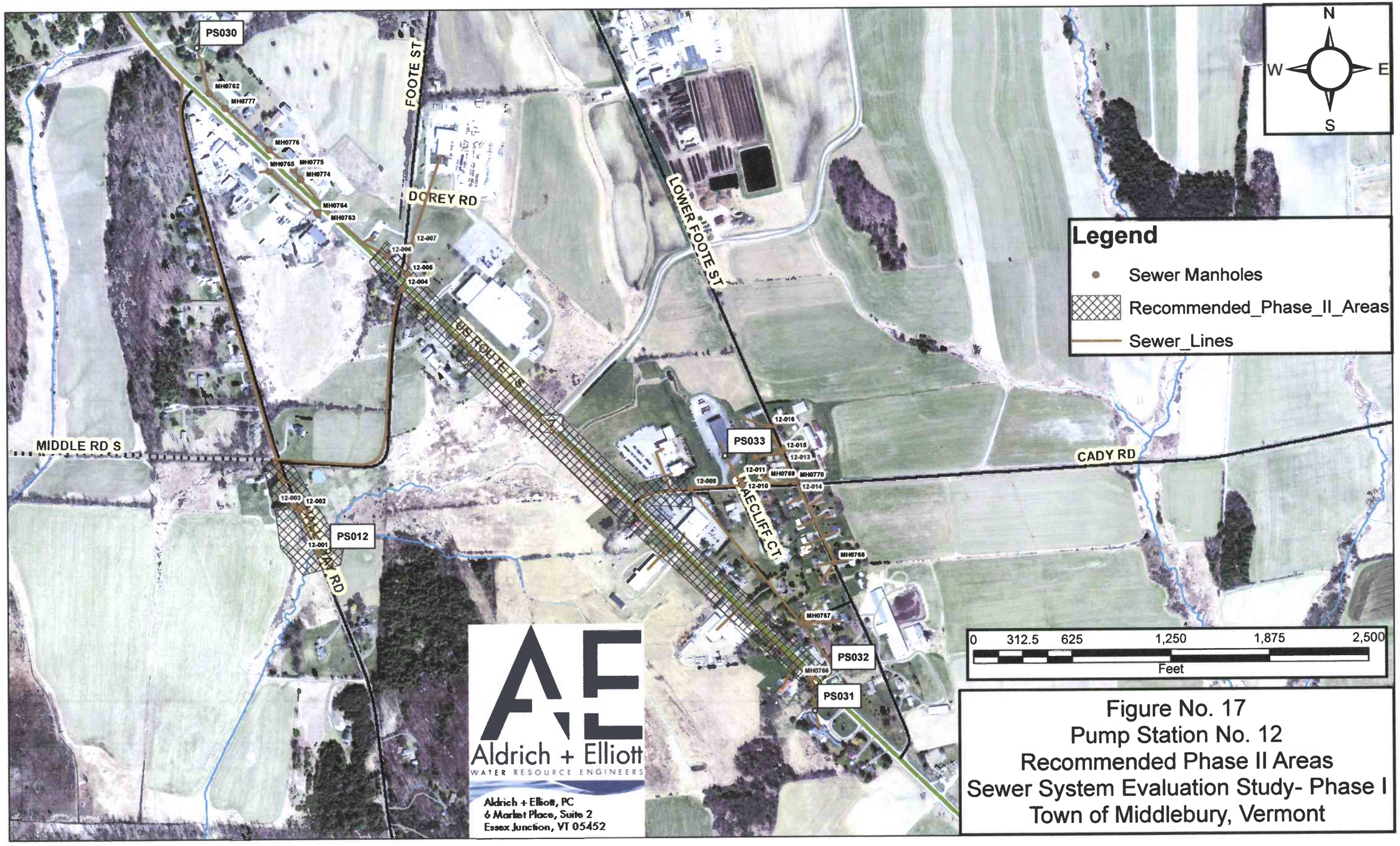

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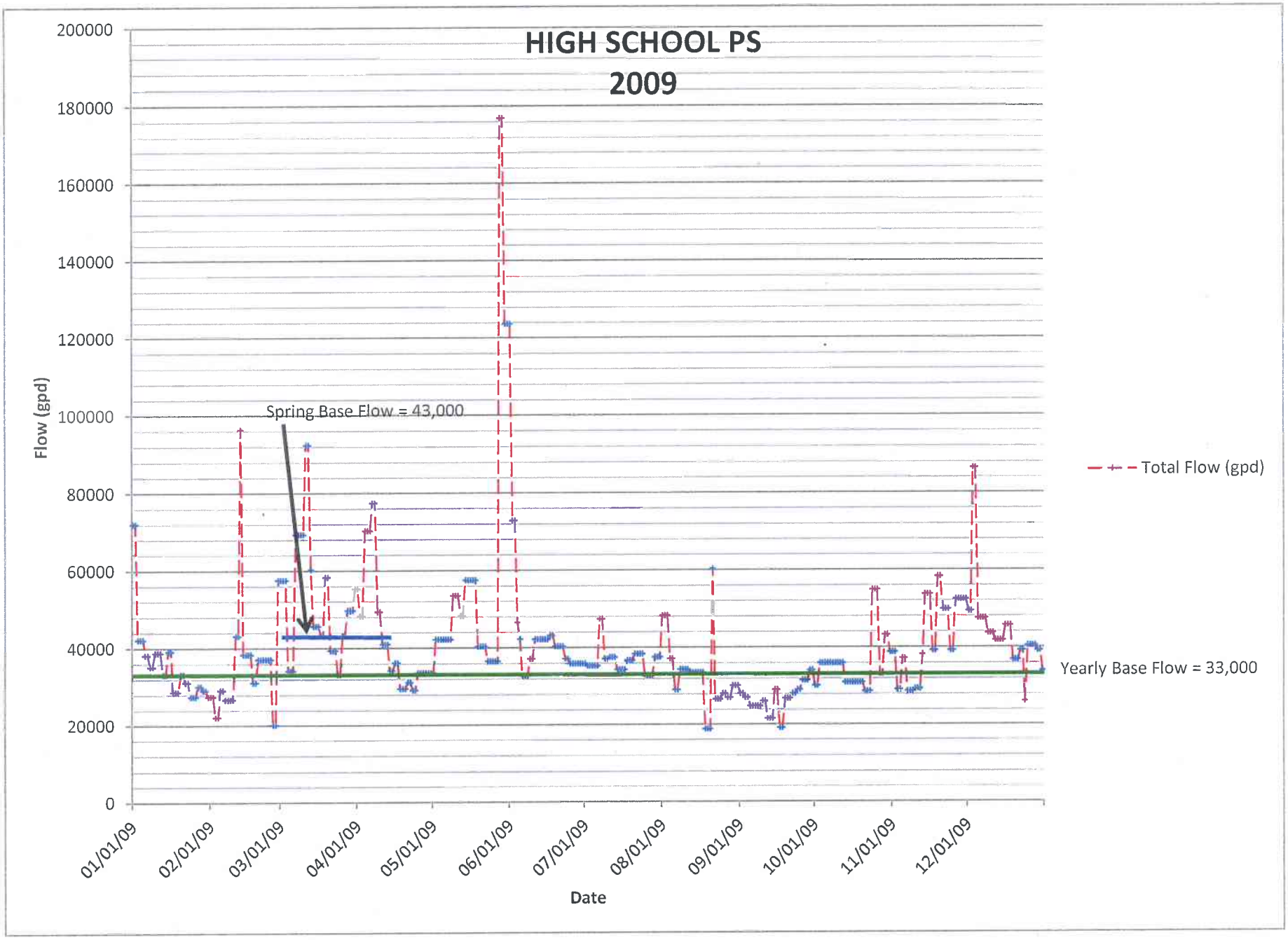
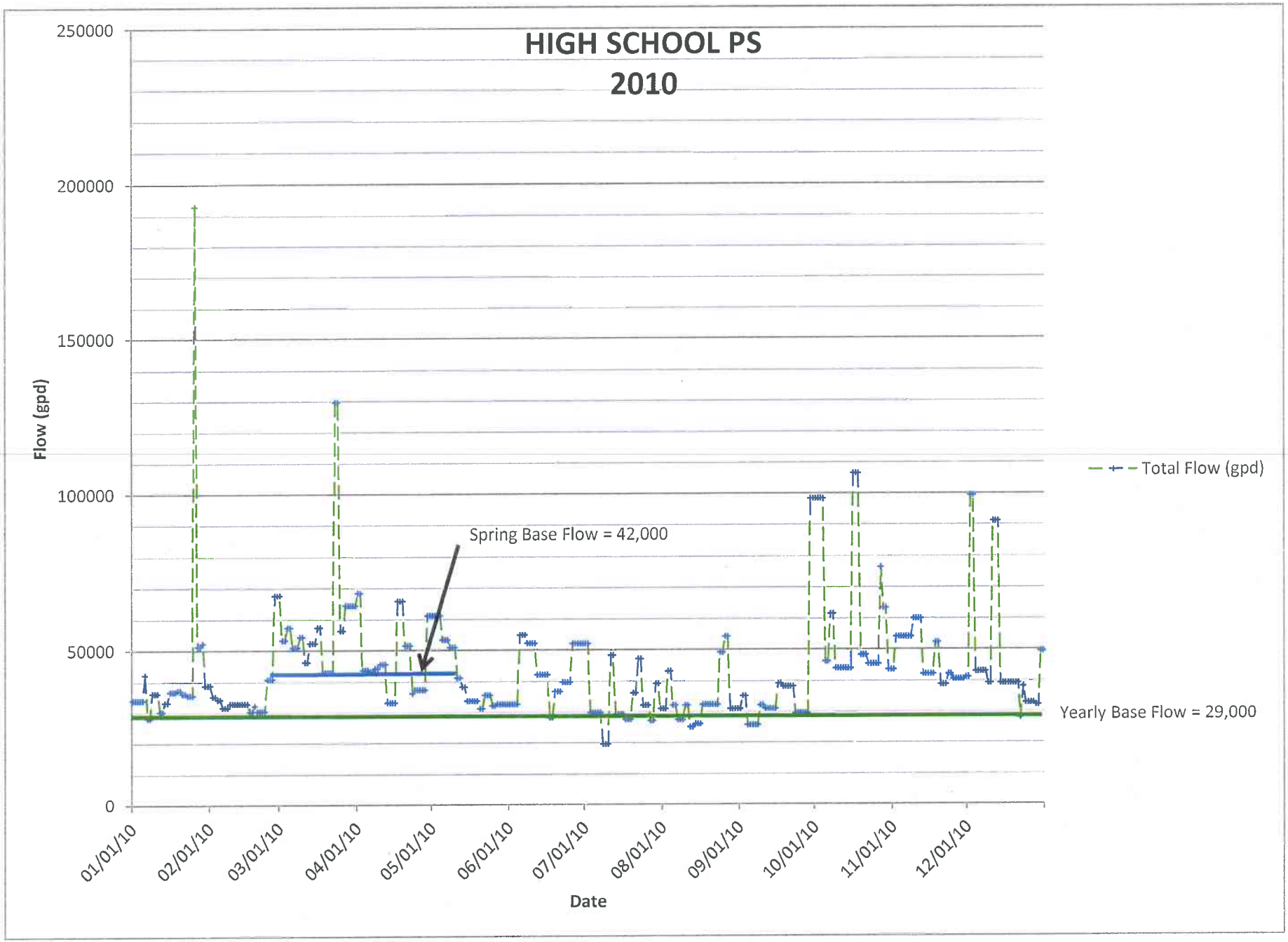
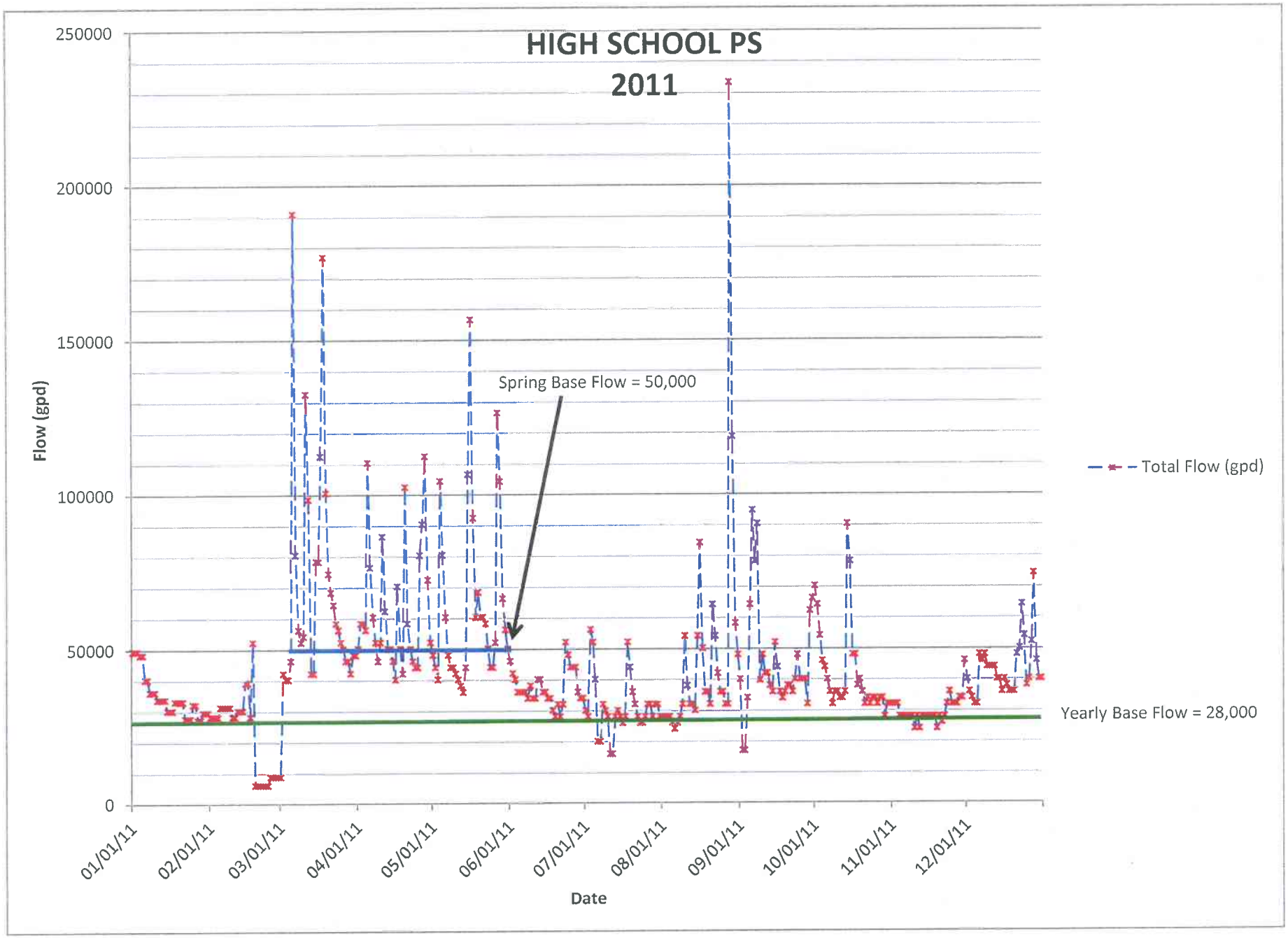
Figure No. 17
Pump Station No. 12
Recommended Phase II Areas
Sewer System Evaluation Study- Phase I
Town of Middlebury, Vermont

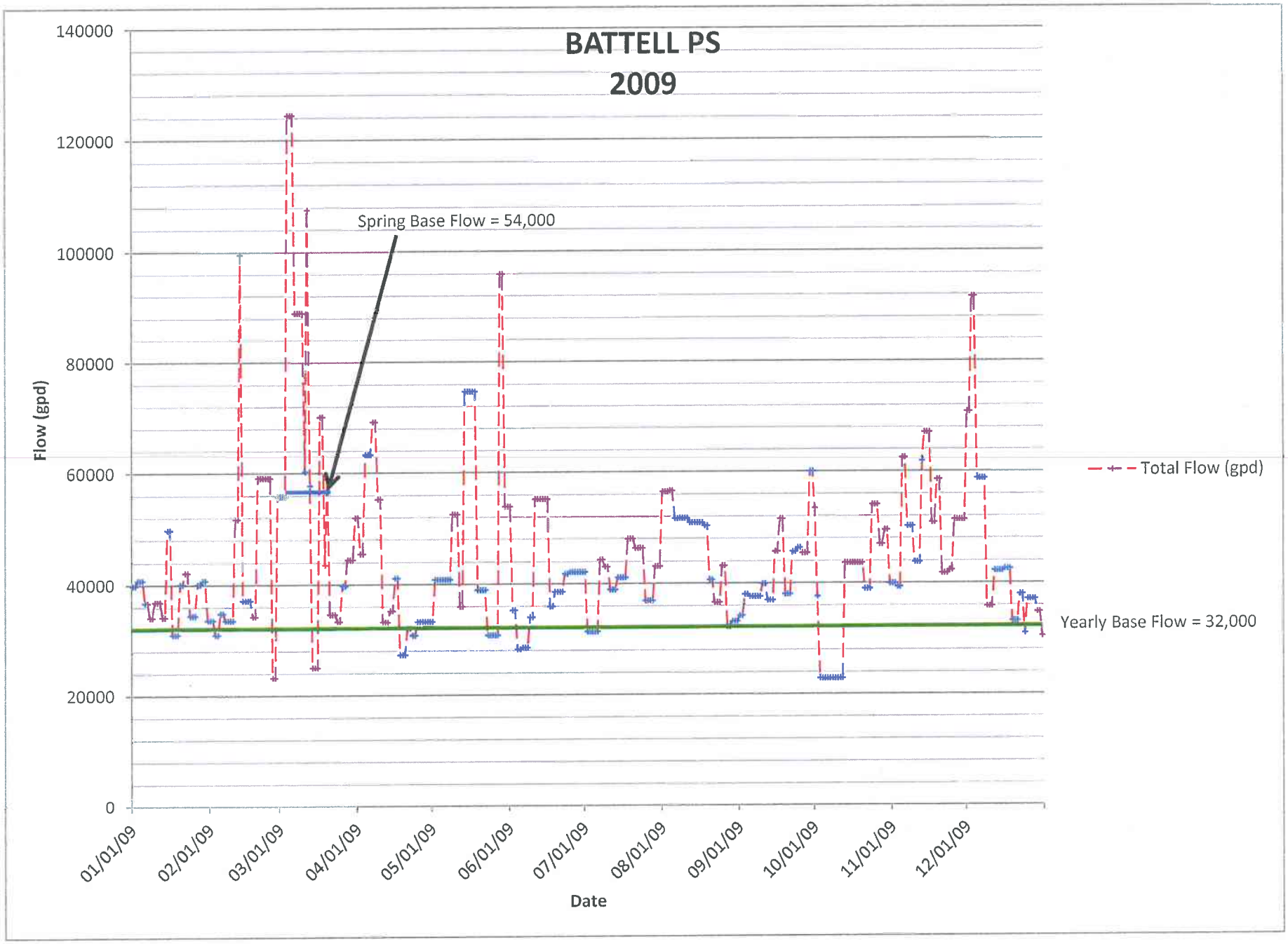
APPENDIX B

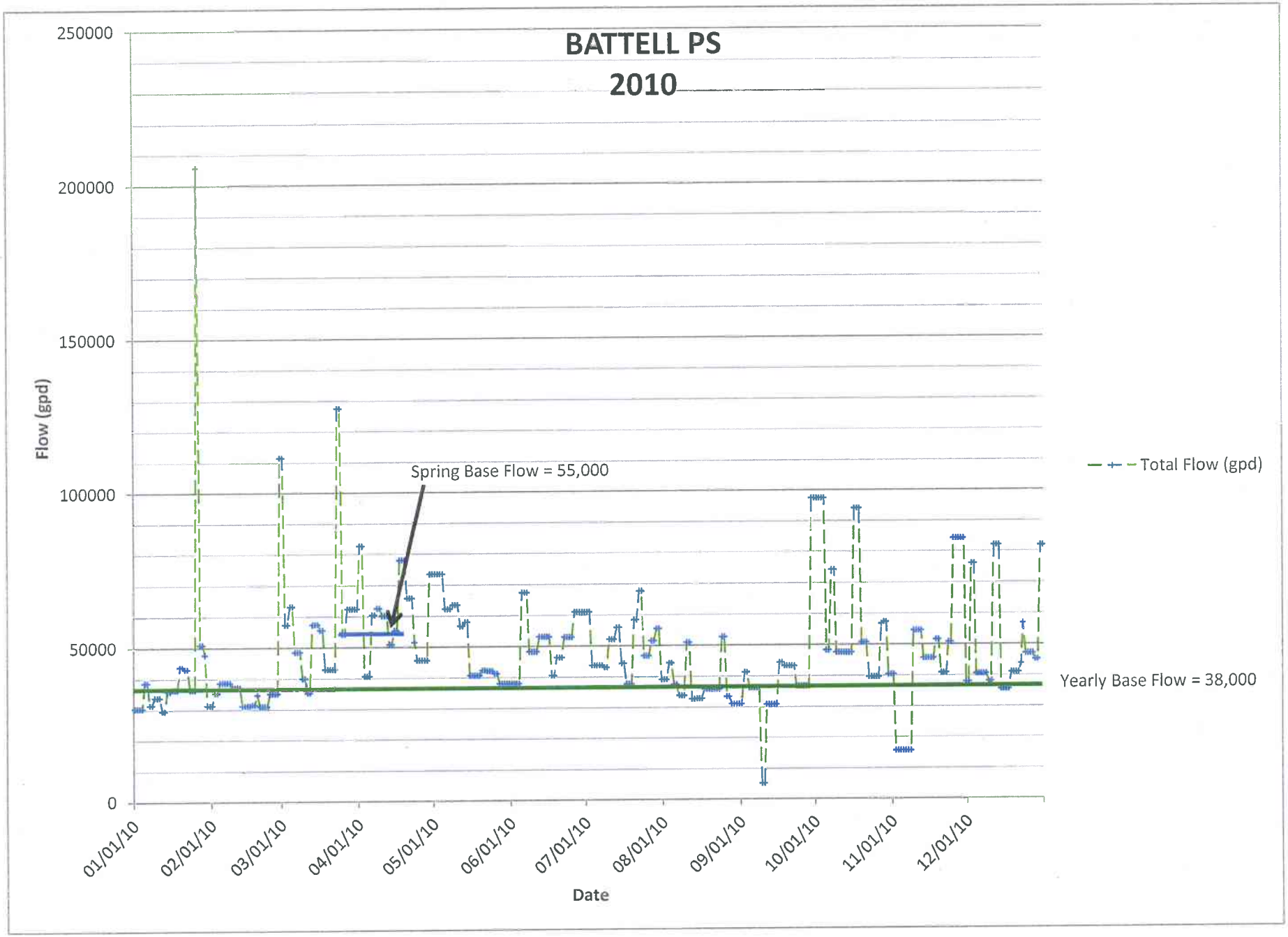
PUMP STATION FLOW DATA

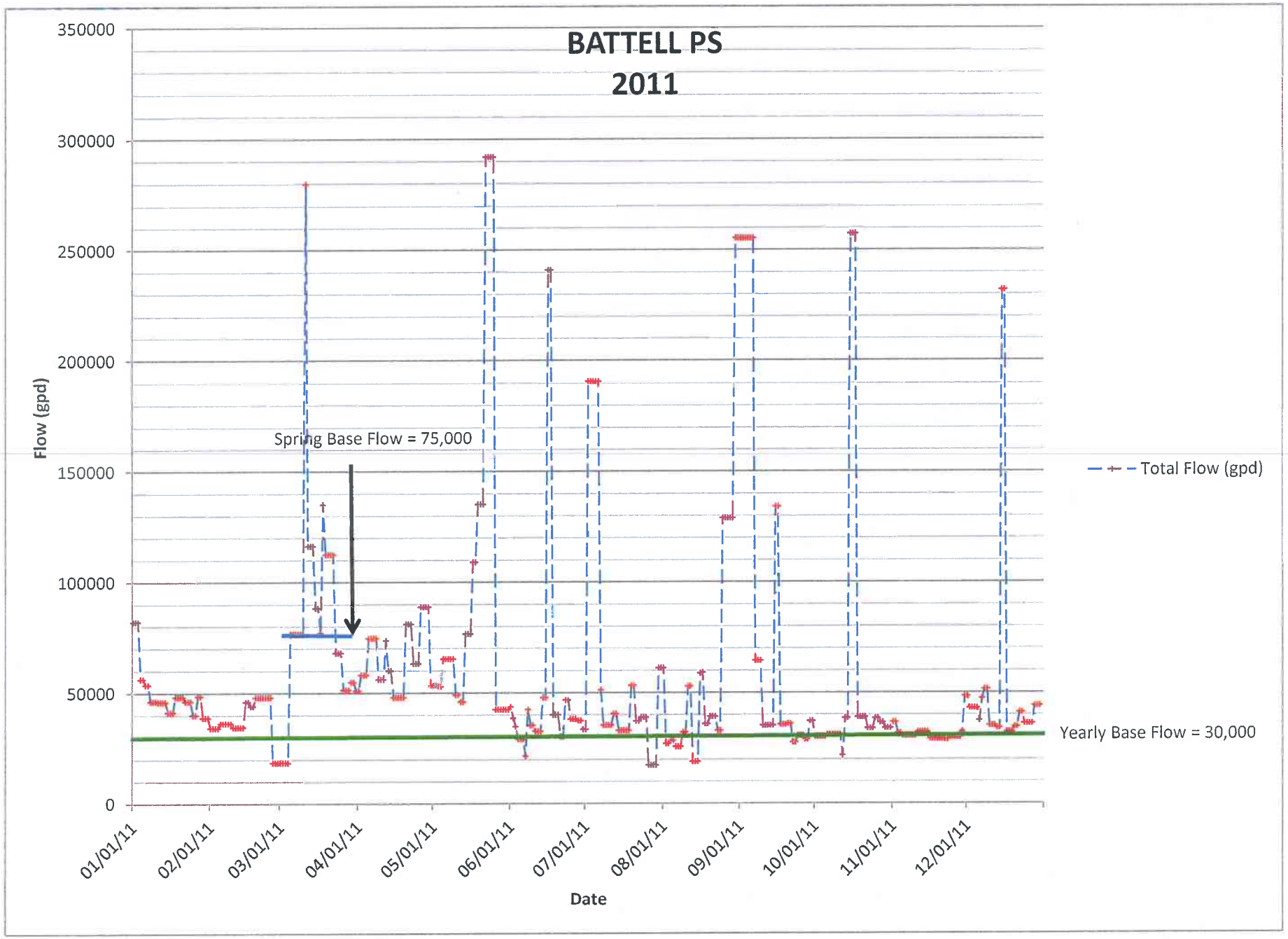

HIGH SCHOOL PS
2009
Flow (gpd)
200000
180000
160000
140000
120000
100000
80000
60000
40000
20000
0
Spring Base Flow = 43,000
Yearly Base Flow = 33,000
Total Flow (gpd)
01/01/09
02/01/09
03/01/09
04/01/09
05/01/09
06/01/09
07/01/09
08/01/09
09/01/09
10/01/09
11/01/09
12/01/09
Date

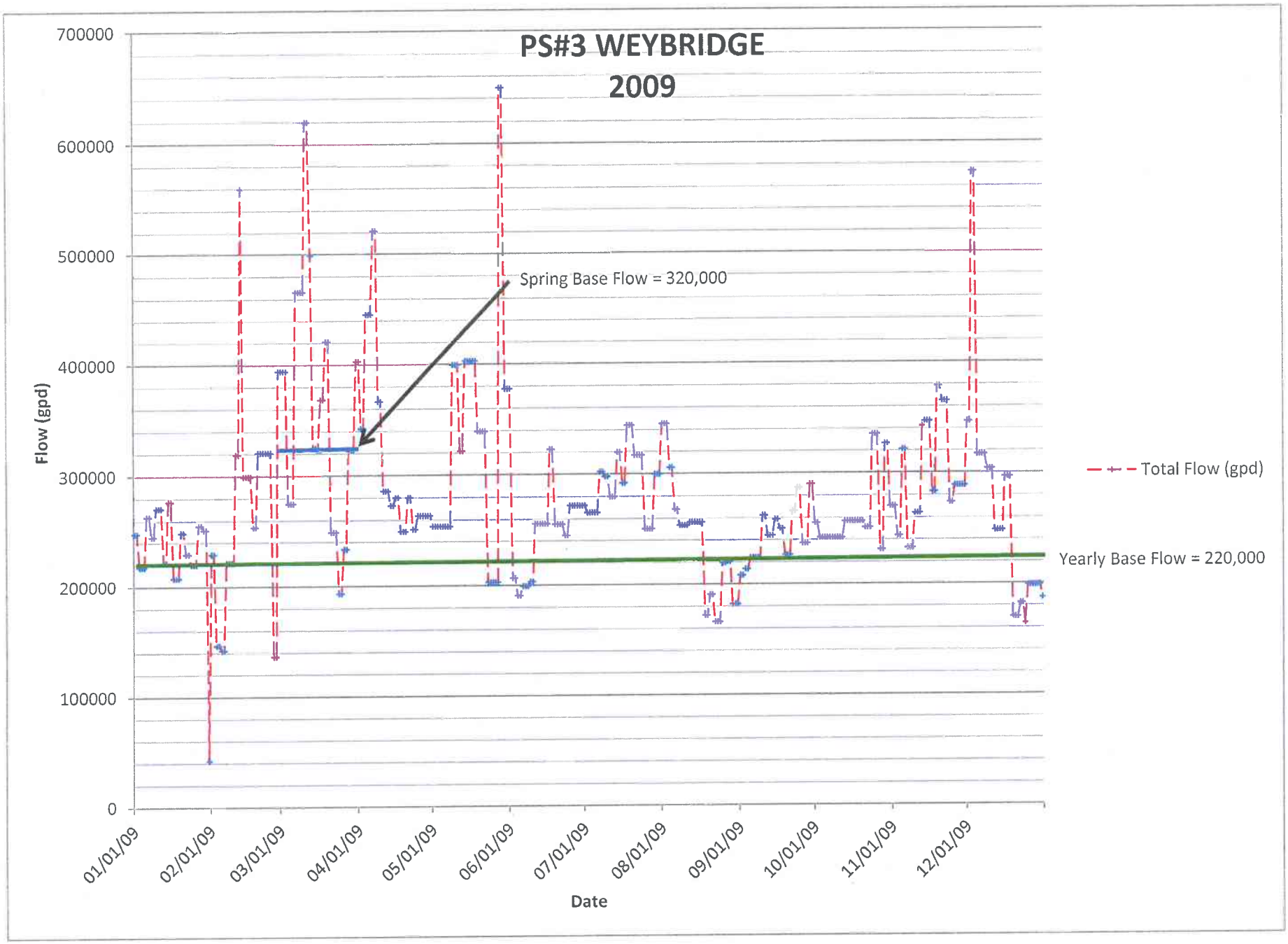

HIGH SCHOOL PS
2010
250000
200000
150000
100000
50000
0
Flow (gpd)
Spring Base Flow = 42,000
Yearly Base Flow = 29,000
Total Flow (gpd)
01/01/10
02/01/10
03/01/10
04/01/10
05/01/10
06/01/10
07/01/10
08/01/10
09/01/10
10/01/10
11/01/10
12/01/10
Date

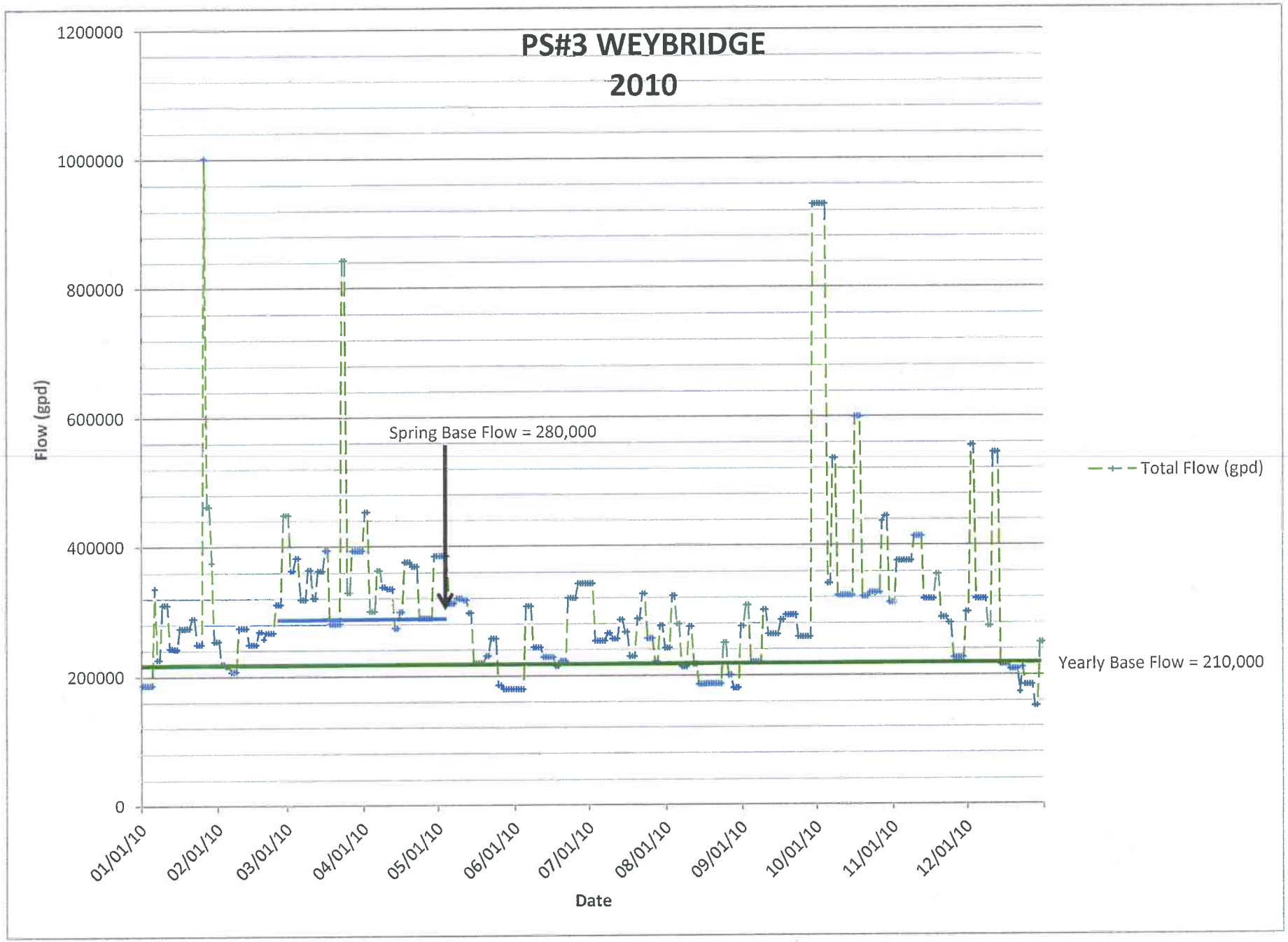

HIGH SCHOOL PS
2011
250000
200000
150000
100000
50000
0
Flow (gpd)
Spring Base Flow = 50,000
Total Flow (gpd)
Yearly Base Flow = 28,000
01/01/11
02/01/11
03/01/11
04/01/11
05/01/11
06/01/11
07/01/11
08/01/11
09/01/11
10/01/11
11/01/11
12/01/11
Date

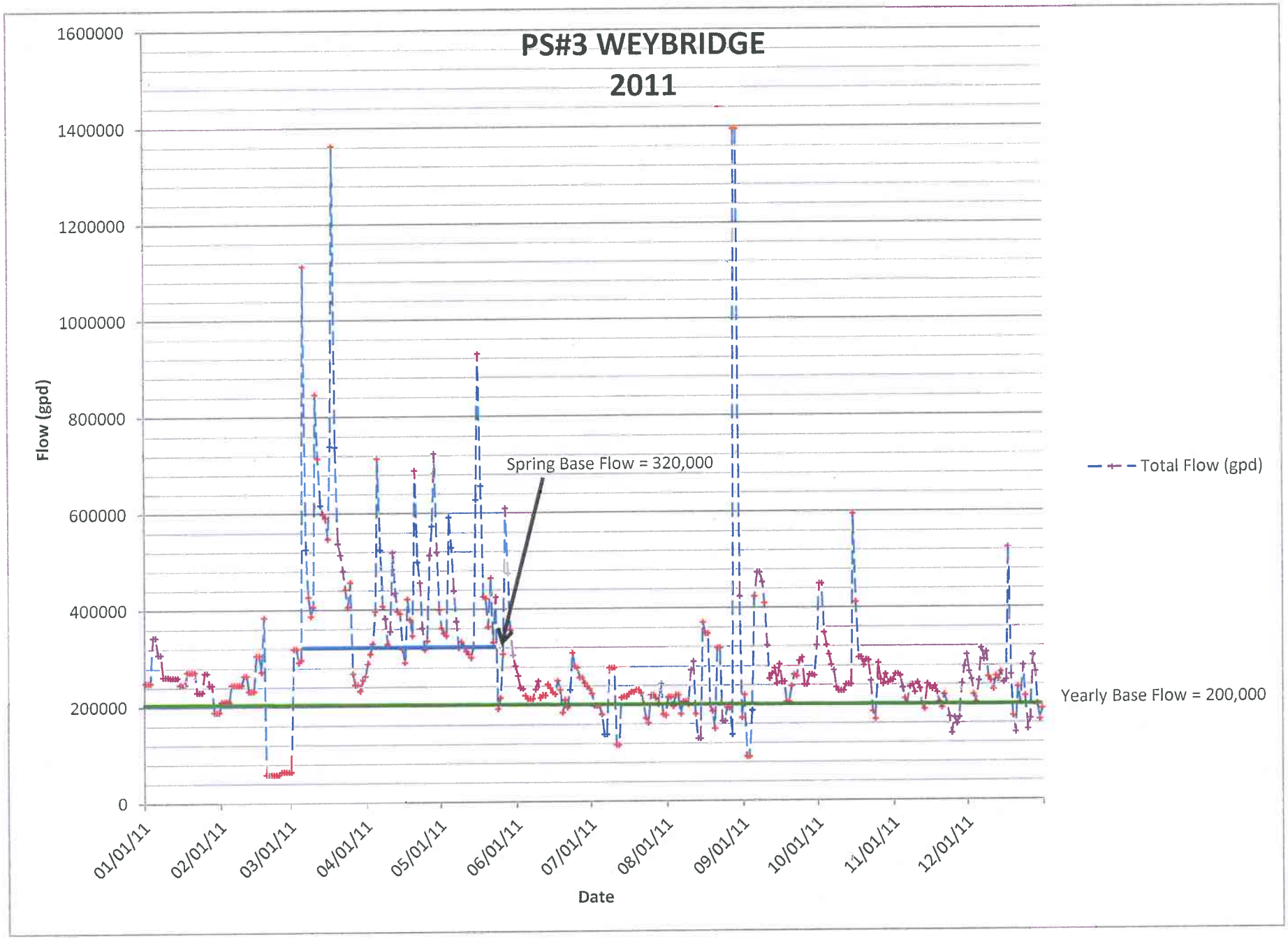

BATTELL PS
2009
Spring Base Flow = 54,000
Yearly Base Flow = 32,000
Total Flow (gpd)
Flow (gpd)
Date
140000
120000
100000
80000
60000
40000
20000
0
01/01/09
02/01/09
03/01/09
04/01/09
05/01/09
06/01/09
07/01/09
08/01/09
09/01/09
10/01/09
11/01/09
12/01/09

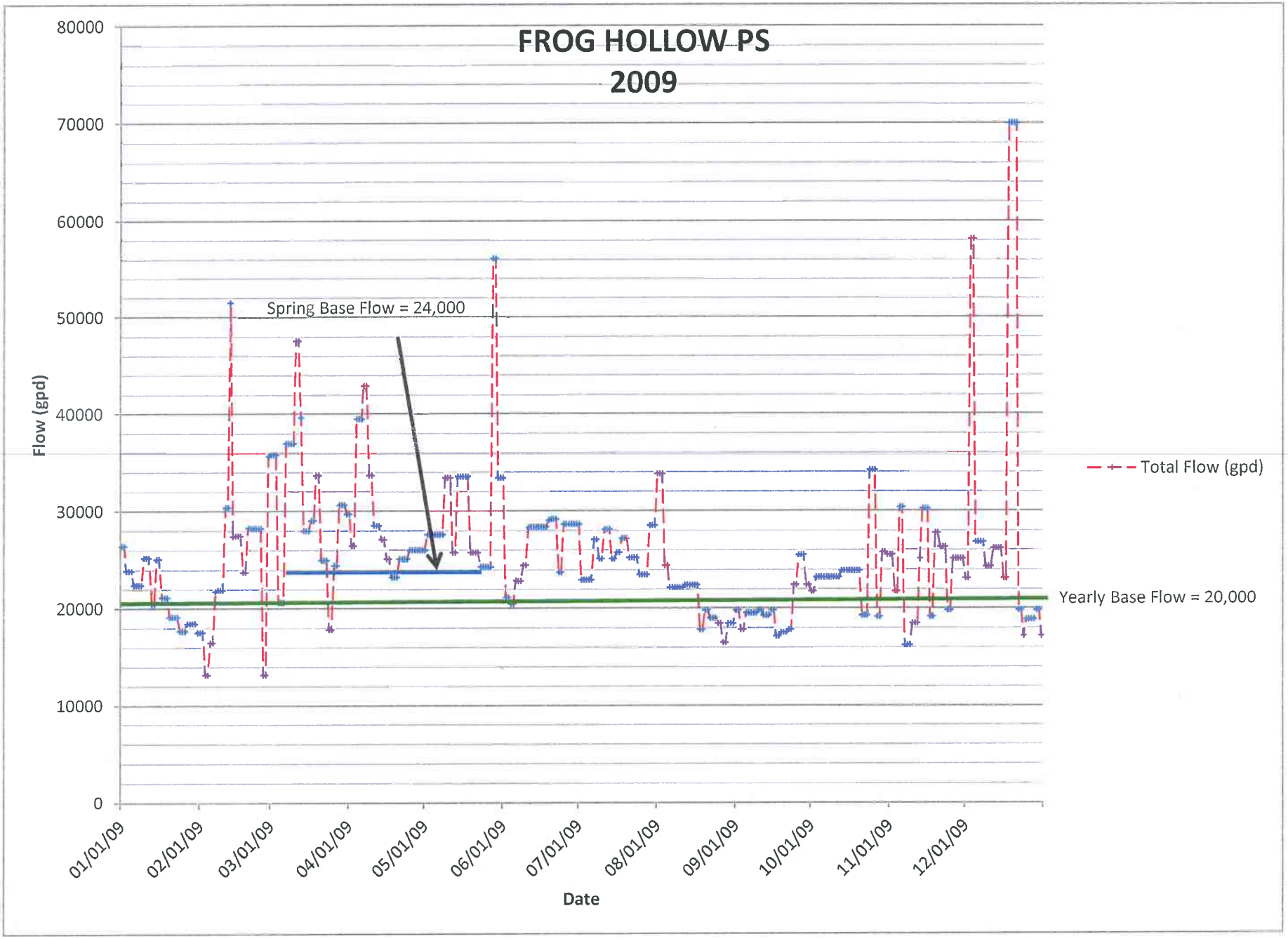

BATTELL PS
2010
250000
200000
150000
100000
50000
0
Flow (gpd)
Spring Base Flow = 55,000
Total Flow (gpd)
Yearly Base Flow = 38,000
01/01/10
02/01/10
03/01/10
04/01/10
05/01/10
06/01/10
07/01/10
08/01/10
09/01/10
10/01/10
11/01/10
12/01/10
Date

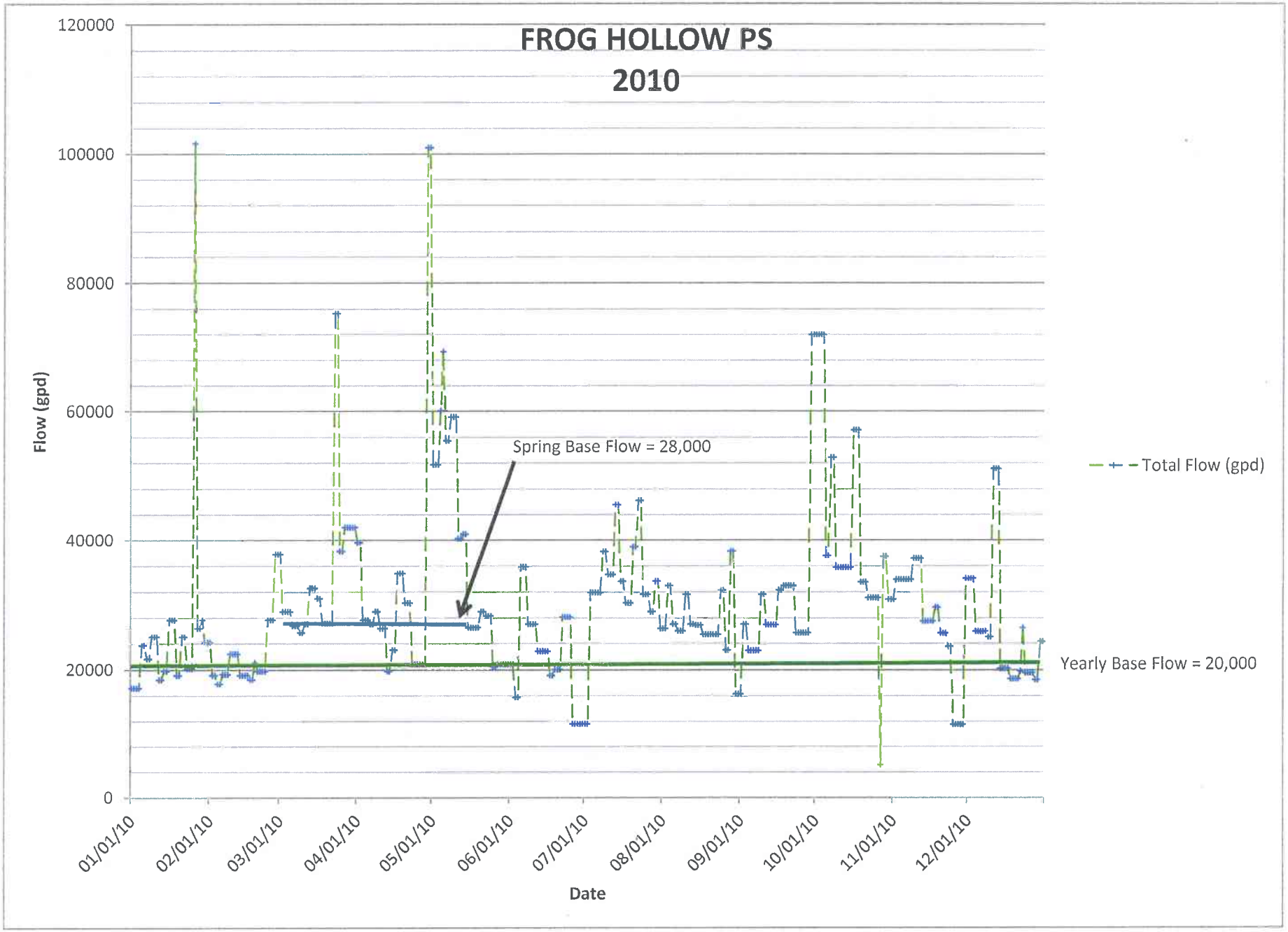

BATTELL PS
2011
350000
300000
250000
200000
150000
100000
50000
0
Flow (gpd)
Spring Base Flow = 75,000
Total Flow (gpd)
Yearly Base Flow = 30,000
01/01/11
02/01/11
03/01/11
04/01/11
05/01/11
06/01/11
07/01/11
08/01/11
09/01/11
10/01/11
11/01/11
12/01/11
Date

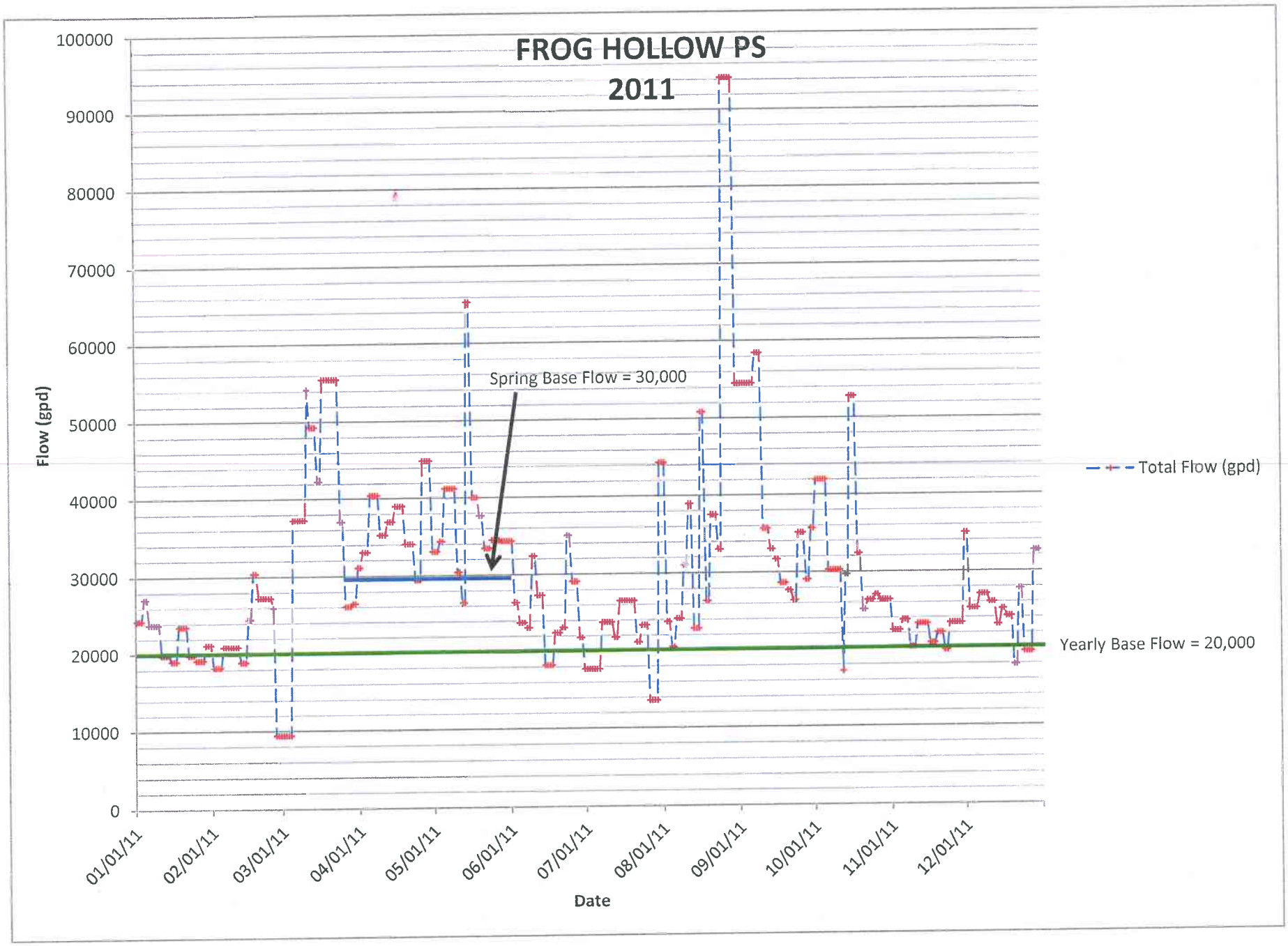

PS#3 WEYBRIDGE
2009
Spring Base Flow = 320,000
Yearly Base Flow = 220,000
Total Flow (gpd)
Flow (gpd)
Date
700000
600000
500000
400000
300000
200000
100000
0
01/01/09
02/01/09
03/01/09
04/01/09
05/01/09
06/01/09
07/01/09
08/01/09
09/01/09
10/01/09
11/01/09
12/01/09

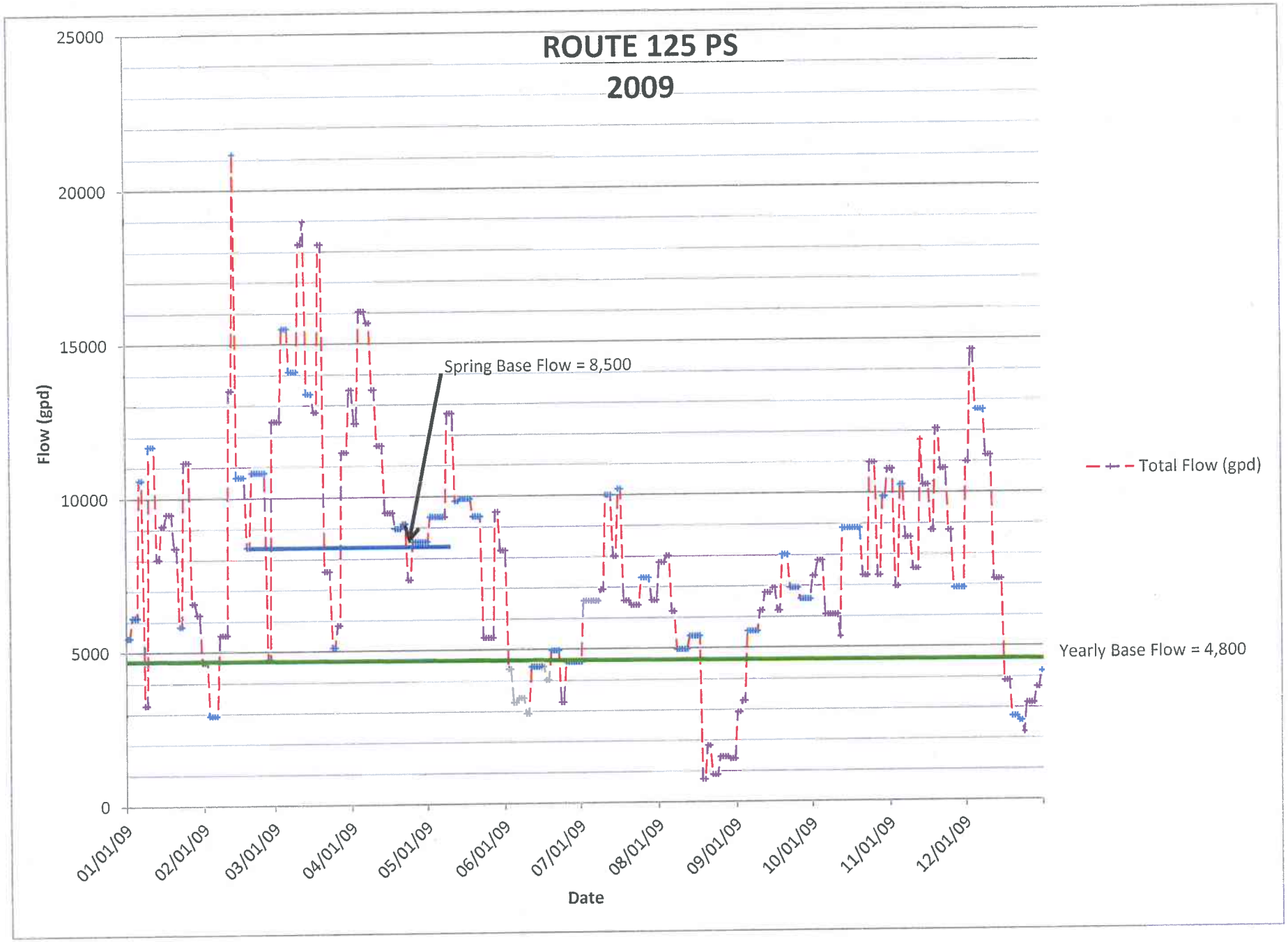

PS#3 WEYBRIDGE
2010
1200000
1000000
800000
600000
400000
200000
0
Flow (gpd)
Spring Base Flow = 280,000
Yearly Base Flow = 210,000
Total Flow (gpd)
01/01/10
02/01/10
03/01/10
04/01/10
05/01/10
06/01/10
07/01/10
08/01/10
09/01/10
10/01/10
11/01/10
12/01/10
Date

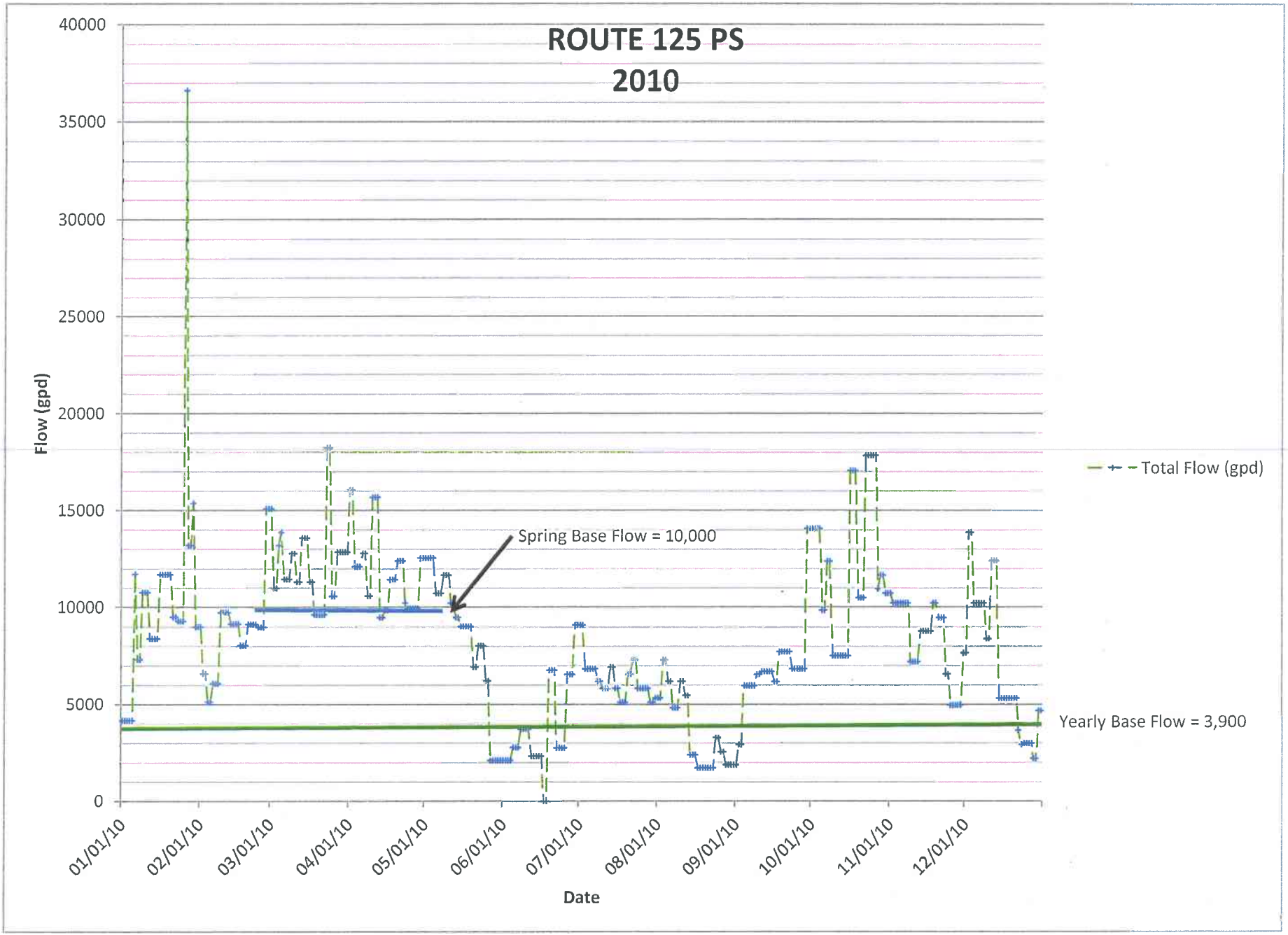

PS#3 WEYBRIDGE
2011
1600000
1400000
1200000
1000000
800000
600000
400000
200000
0
Flow (gpd)
Spring Base Flow = 320,000
Yearly Base Flow = 200,000
Total Flow (gpd)
01/01/11
02/01/11
03/01/11
04/01/11
05/01/11
06/01/11
07/01/11
08/01/11
09/01/11
10/01/11
11/01/11
12/01/11
Date

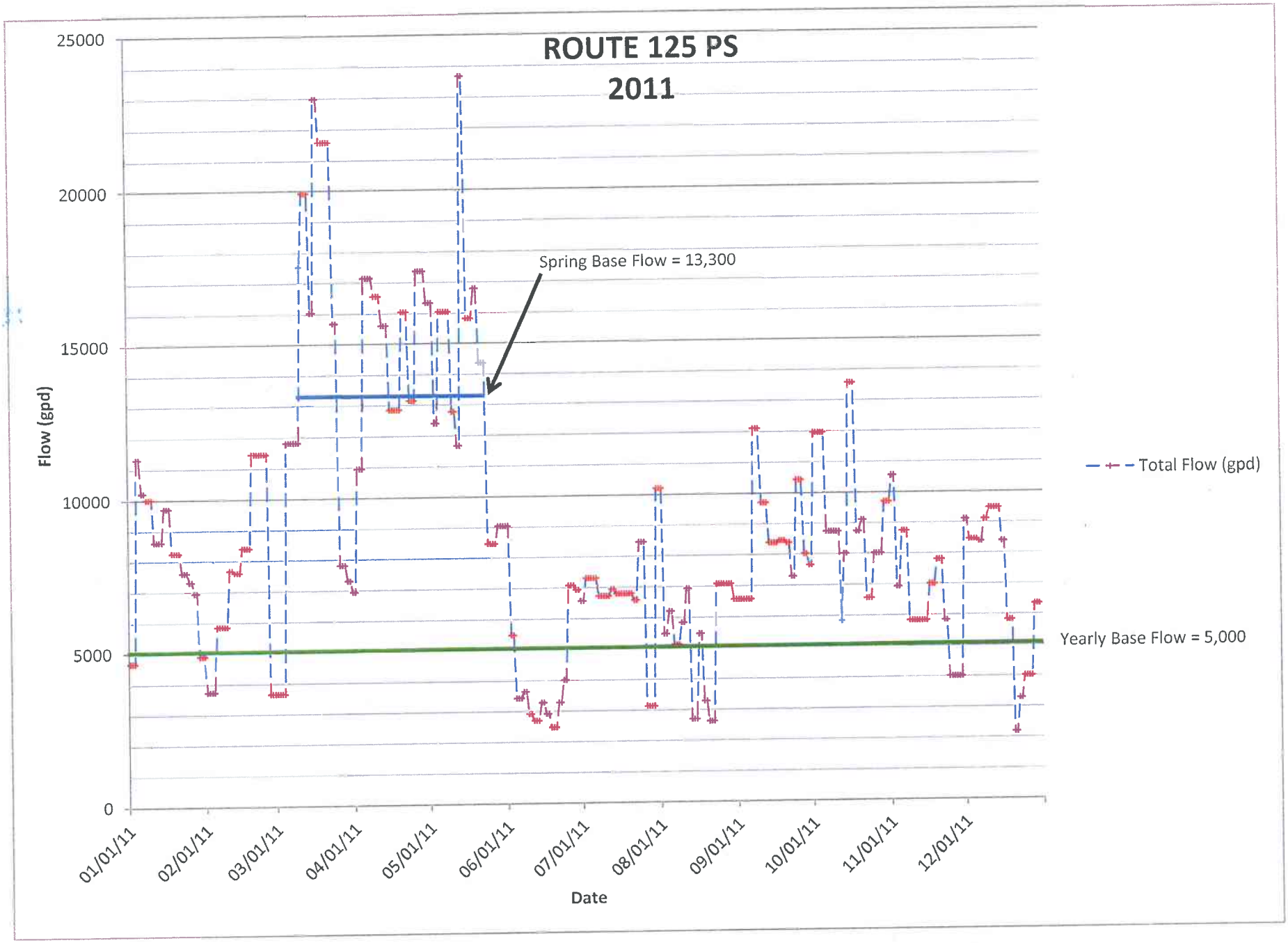

FROG HOLLOW PS
2009
Spring Base Flow = 24,000
Yearly Base Flow = 20,000
Total Flow (gpd)
Flow (gpd)
Date
80000
70000
60000
50000
40000
30000
20000
10000
0
01/01/09
02/01/09
03/01/09
04/01/09
05/01/09
06/01/09
07/01/09
08/01/09
09/01/09
10/01/09
11/01/09
12/01/09

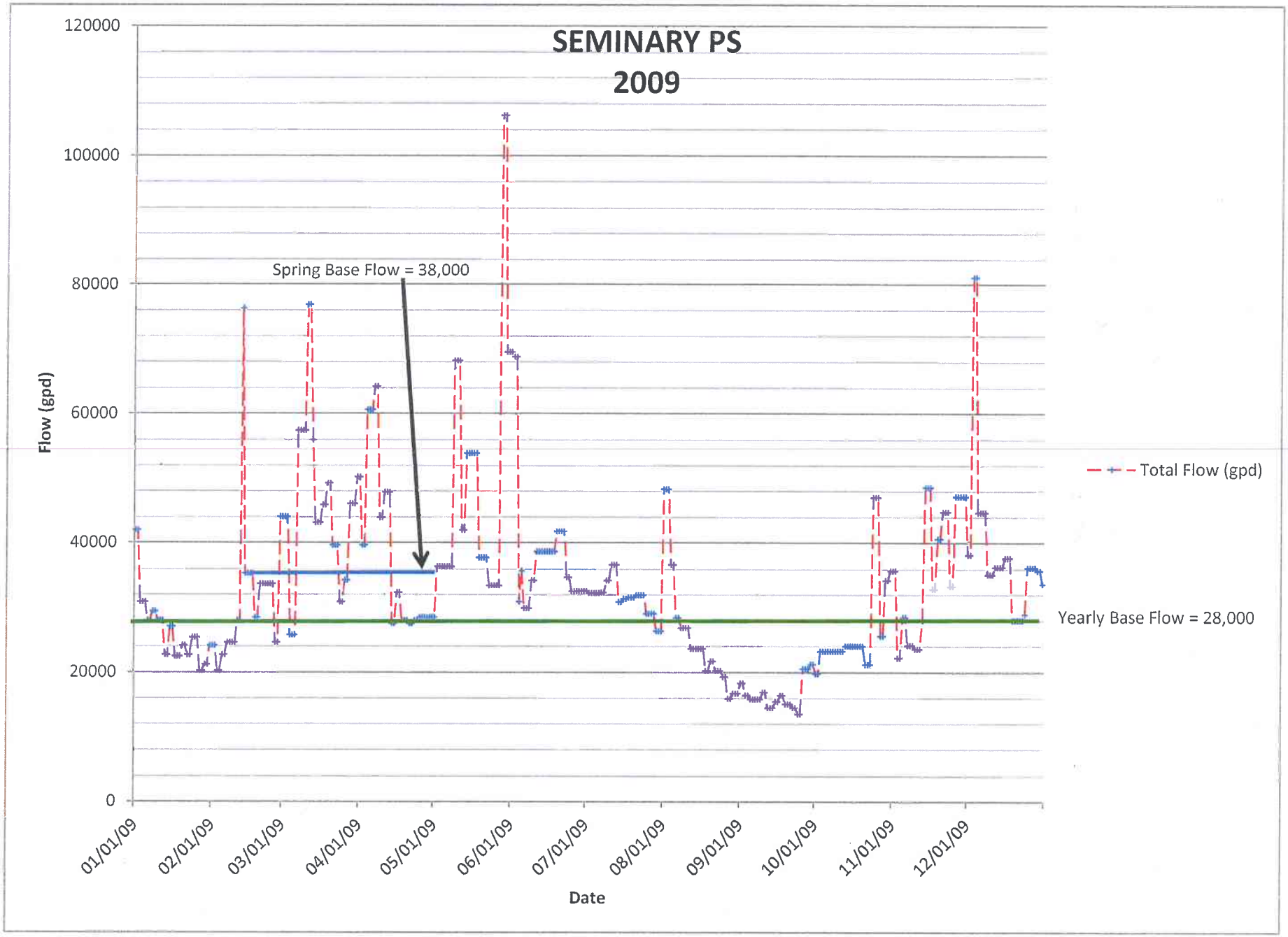

FROG HOLLOW PS
2010
120000
100000
80000
60000
40000
20000
0
Flow (gpd)
Spring Base Flow = 28,000
Yearly Base Flow = 20,000
Total Flow (gpd)
01/01/10
02/01/10
03/01/10
04/01/10
05/01/10
06/01/10
07/01/10
08/01/10
09/01/10
10/01/10
11/01/10
12/01/10
Date

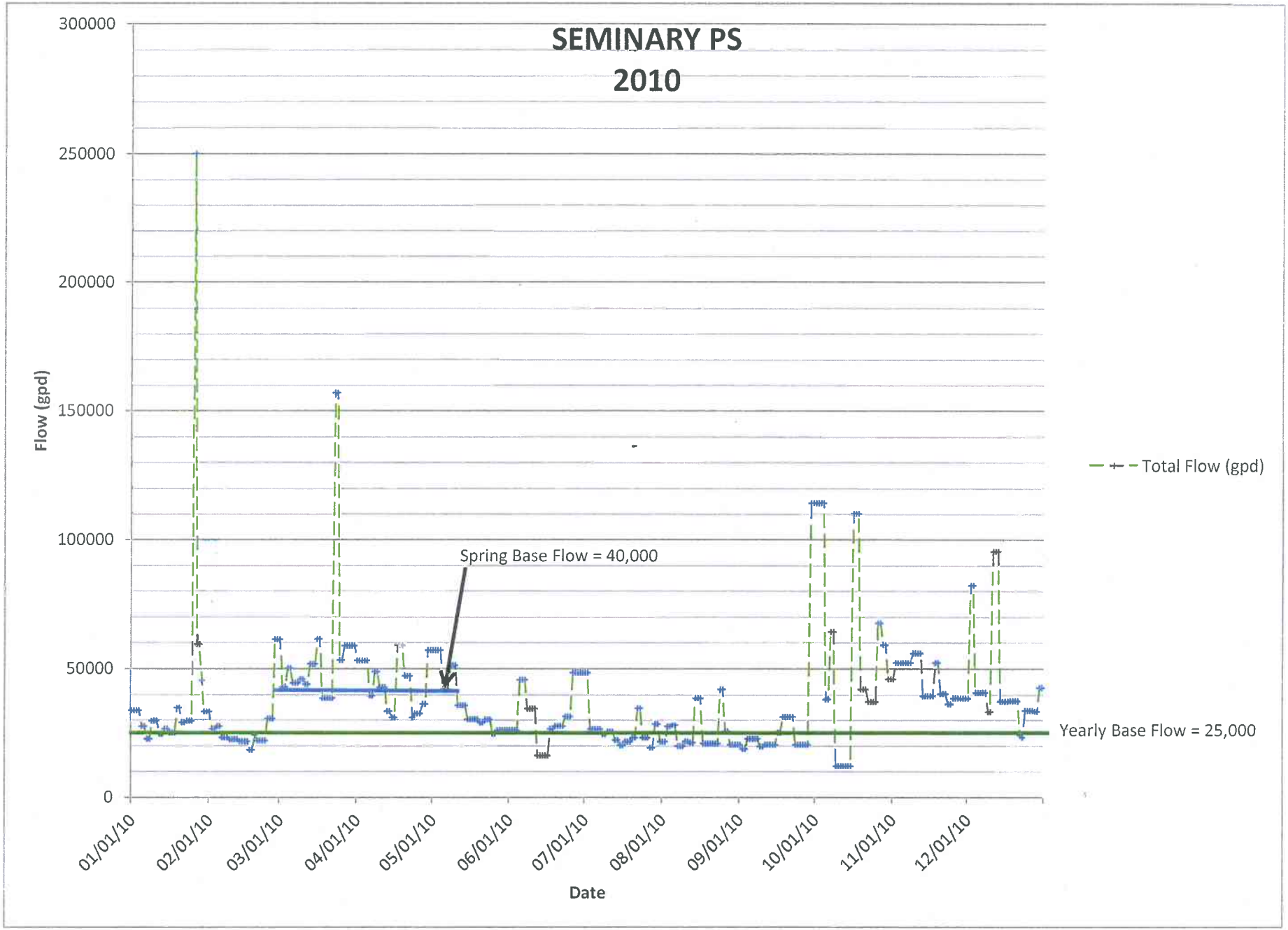

FROG HOLLOW PS
2011
Flow (gpd)
100000
90000
80000
70000
60000
50000
40000
30000
20000
10000
0
Spring Base Flow = 30,000
Yearly Base Flow = 20,000
Total Flow (gpd)
01/01/11
02/01/11
03/01/11
04/01/11
05/01/11
06/01/11
07/01/11
08/01/11
09/01/11
10/01/11
11/01/11
12/01/11
Date

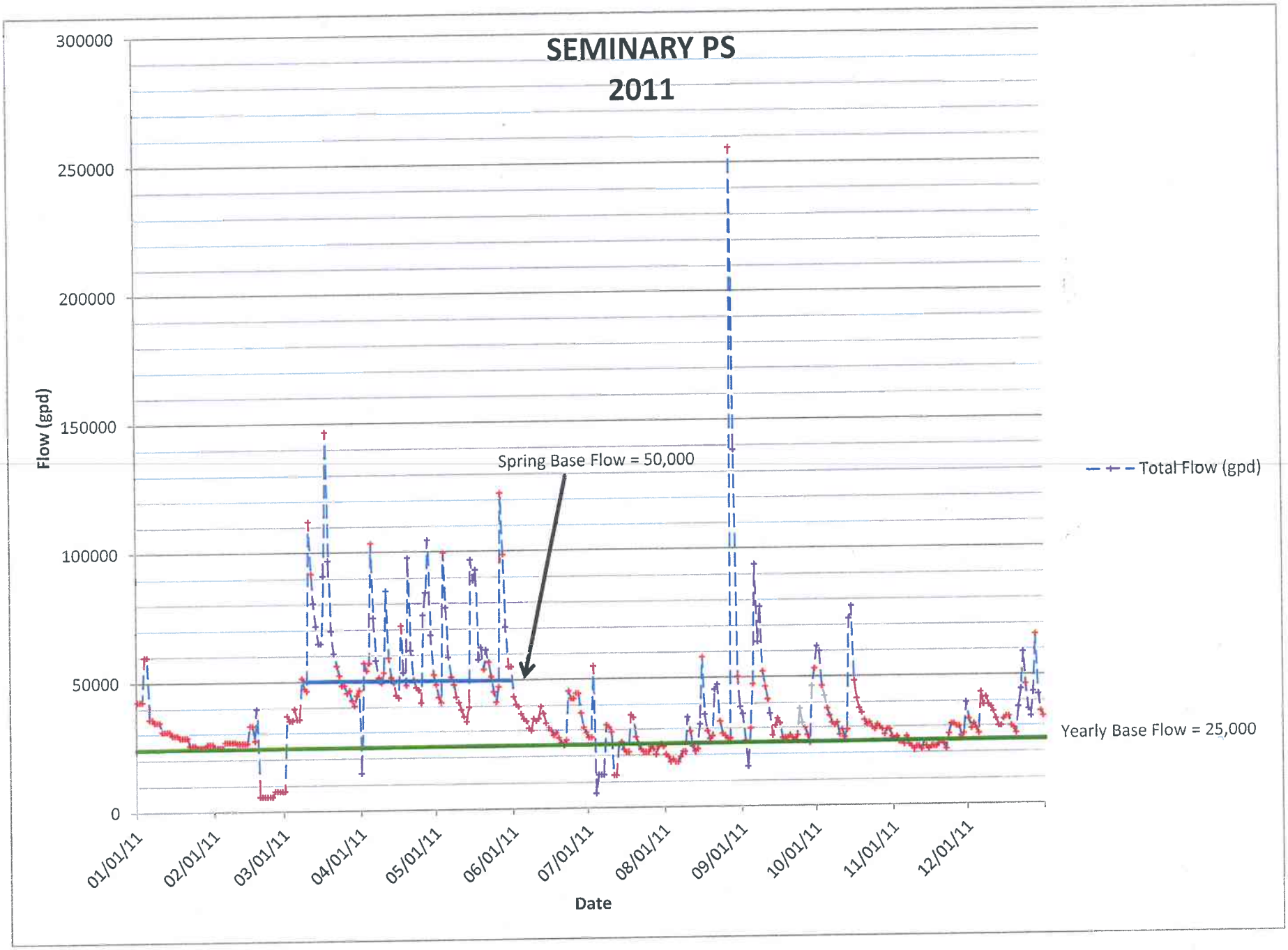

ROUTE 125 PS
2009
25000
20000
15000
10000
5000
0
Flow (gpd)
Spring Base Flow = 8,500
Yearly Base Flow = 4,800
Total Flow (gpd)
01/01/09
02/01/09
03/01/09
04/01/09
05/01/09
06/01/09
07/01/09
08/01/09
09/01/09
10/01/09
11/01/09
12/01/09
Date

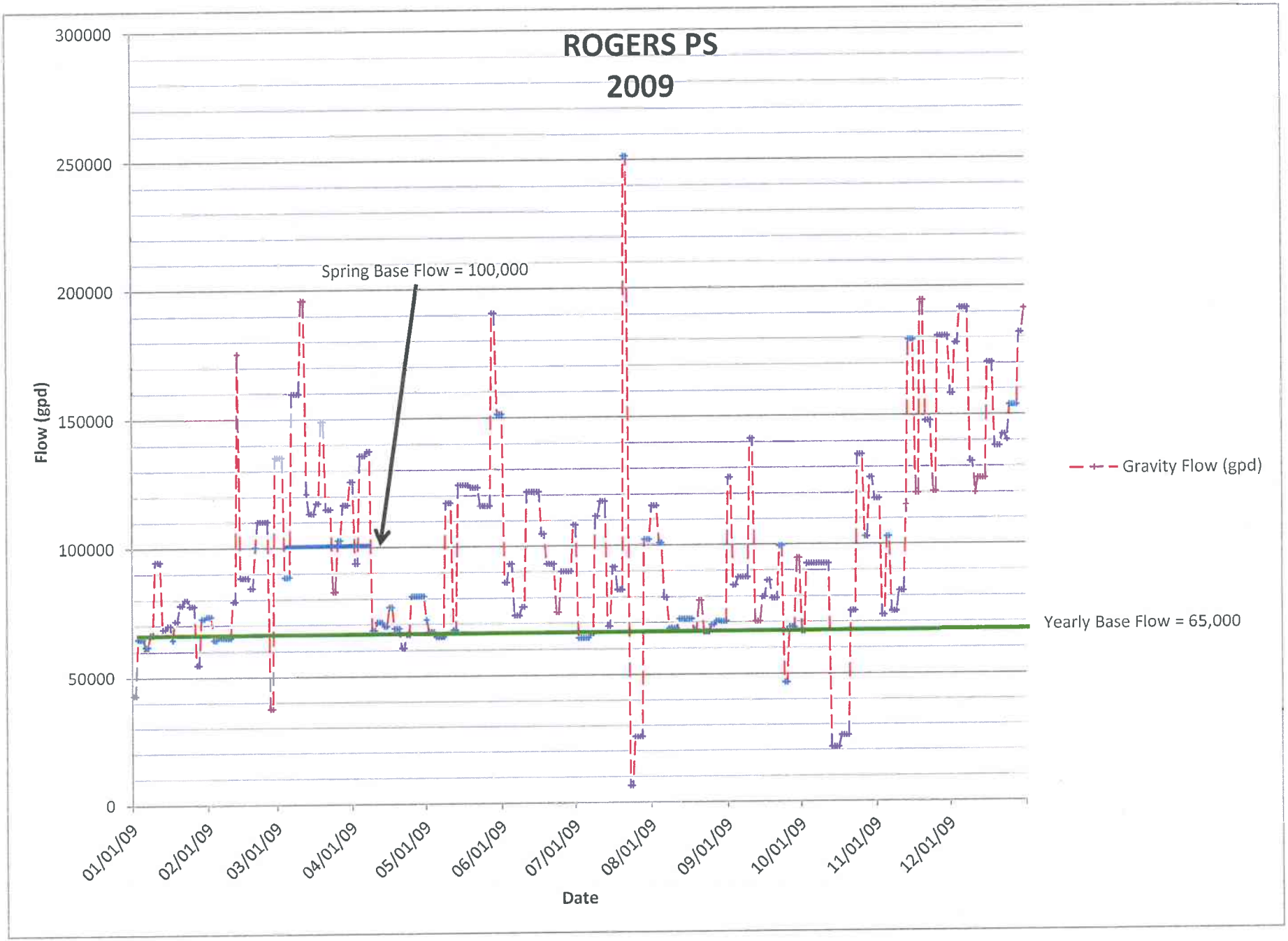

ROUTE 125 PS
2010
40000
35000
30000
25000
20000
15000
10000
5000
0
Flow (gpd)
Spring Base Flow = 10,000
Yearly Base Flow = 3,900
Total Flow (gpd)
01/01/10
02/01/10
03/01/10
04/01/10
05/01/10
06/01/10
07/01/10
08/01/10
09/01/10
10/01/10
11/01/10
12/01/10
Date

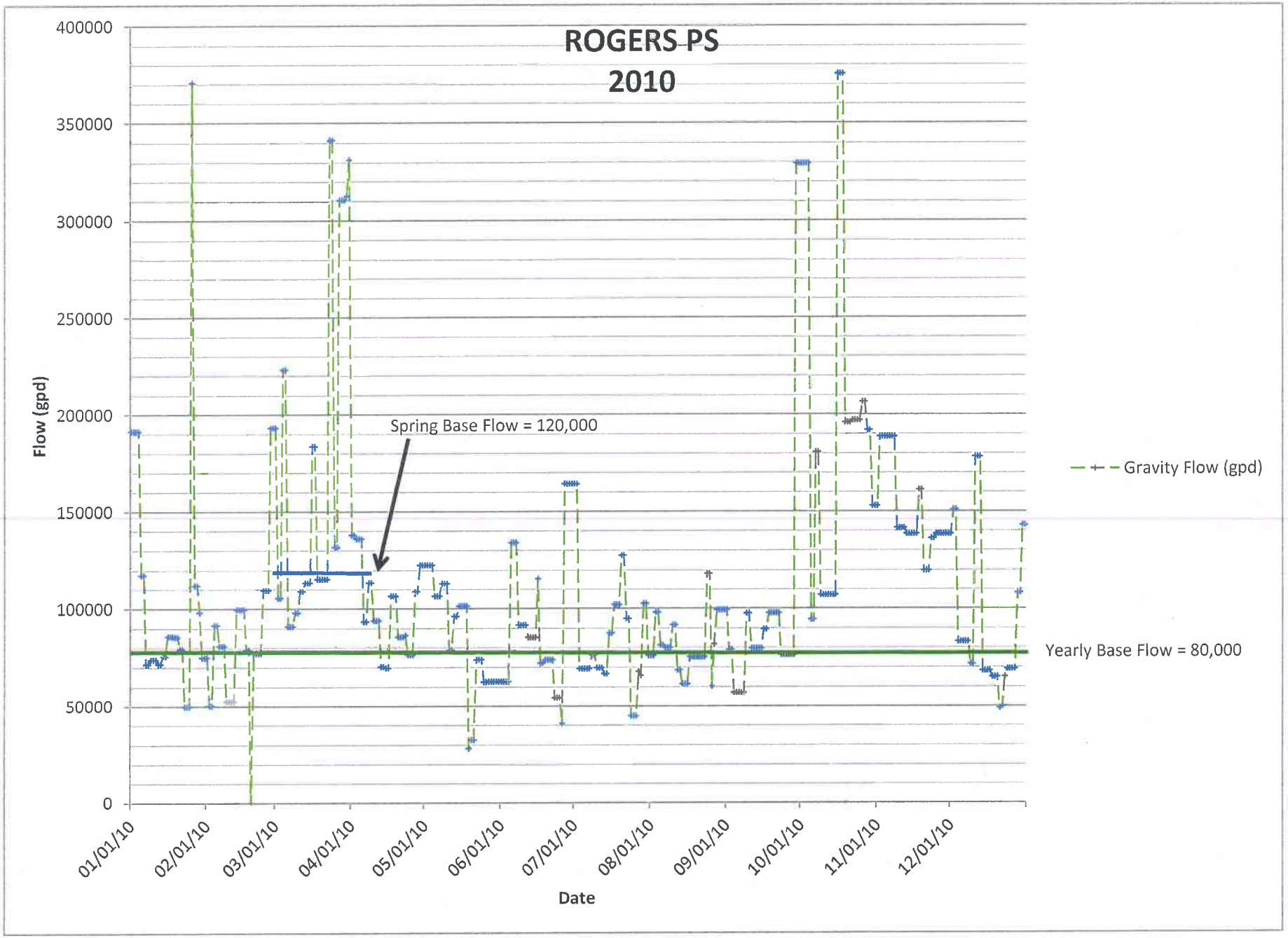

ROUTE 125 PS
2011
Spring Base Flow = 13,300
Yearly Base Flow = 5,000
Total Flow (gpd)
Flow (gpd)
Date
25000
20000
15000
10000
5000
0
01/01/11
02/01/11
03/01/11
04/01/11
05/01/11
06/01/11
07/01/11
08/01/11
09/01/11
10/01/11
11/01/11
12/01/11

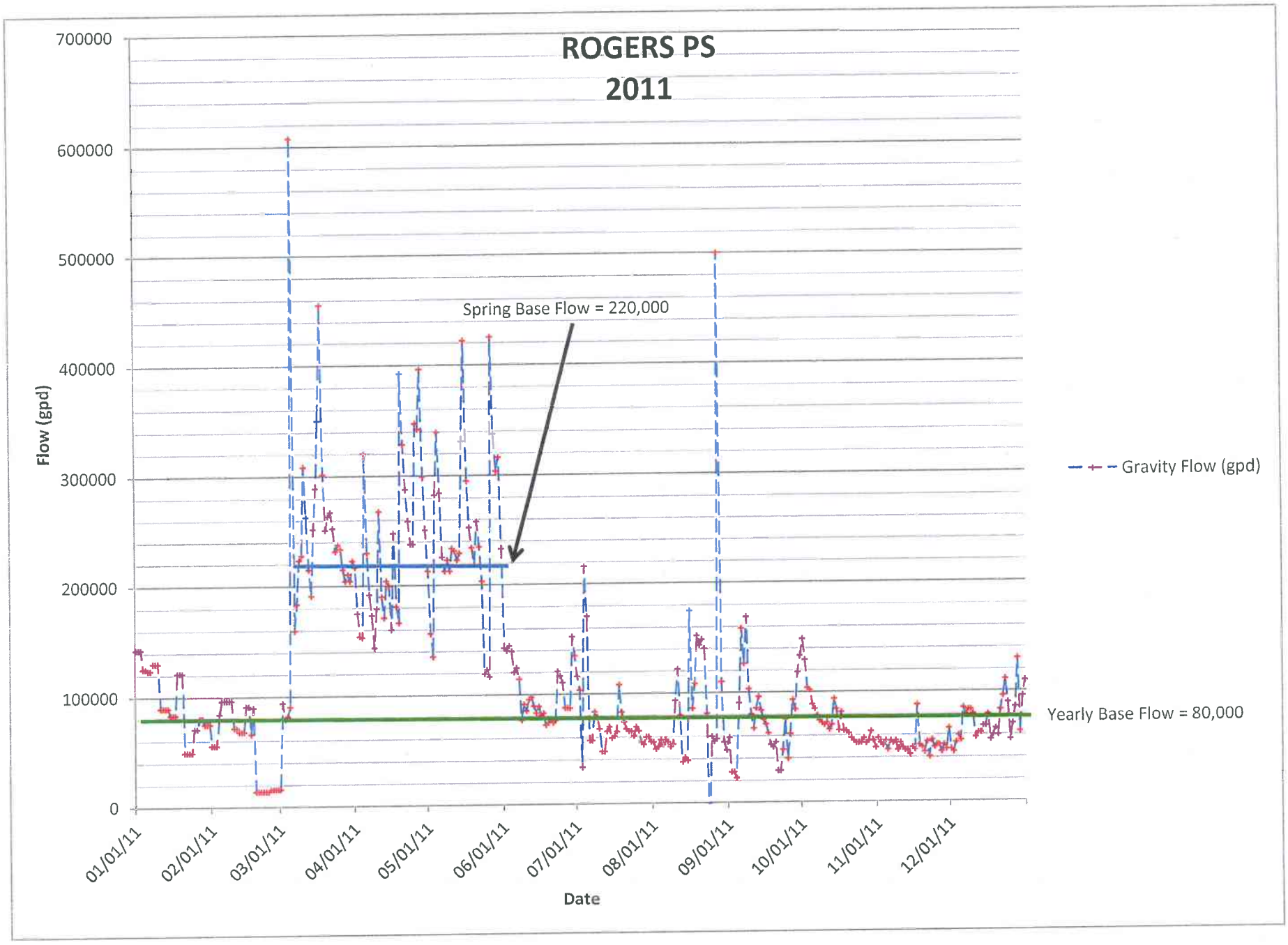

SEMINARY PS
2009
120000
100000
80000
60000
40000
20000
0
Flow (gpd)
Spring Base Flow = 38,000
Yearly Base Flow = 28,000
Total Flow (gpd)
01/01/09
02/01/09
03/01/09
04/01/09
05/01/09
06/01/09
07/01/09
08/01/09
09/01/09
10/01/09
11/01/09
12/01/09
Date

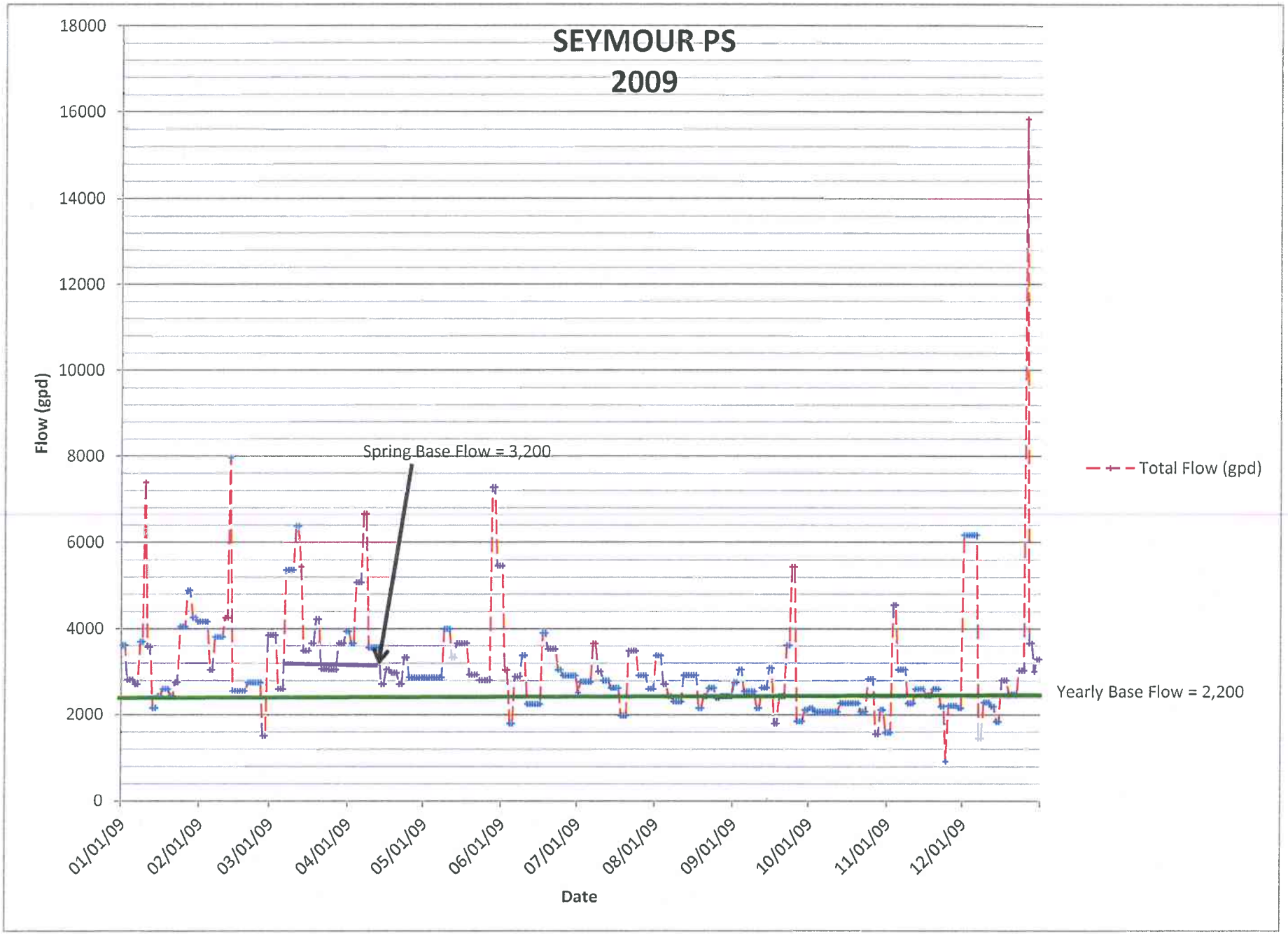

SEMINARY PS
2010
300000
250000
200000
150000
100000
50000
0
Flow (gpd)
Spring Base Flow = 40,000
Yearly Base Flow = 25,000
Total Flow (gpd)
01/01/10
02/01/10
03/01/10
04/01/10
05/01/10
06/01/10
07/01/10
08/01/10
09/01/10
10/01/10
11/01/10
12/01/10
Date

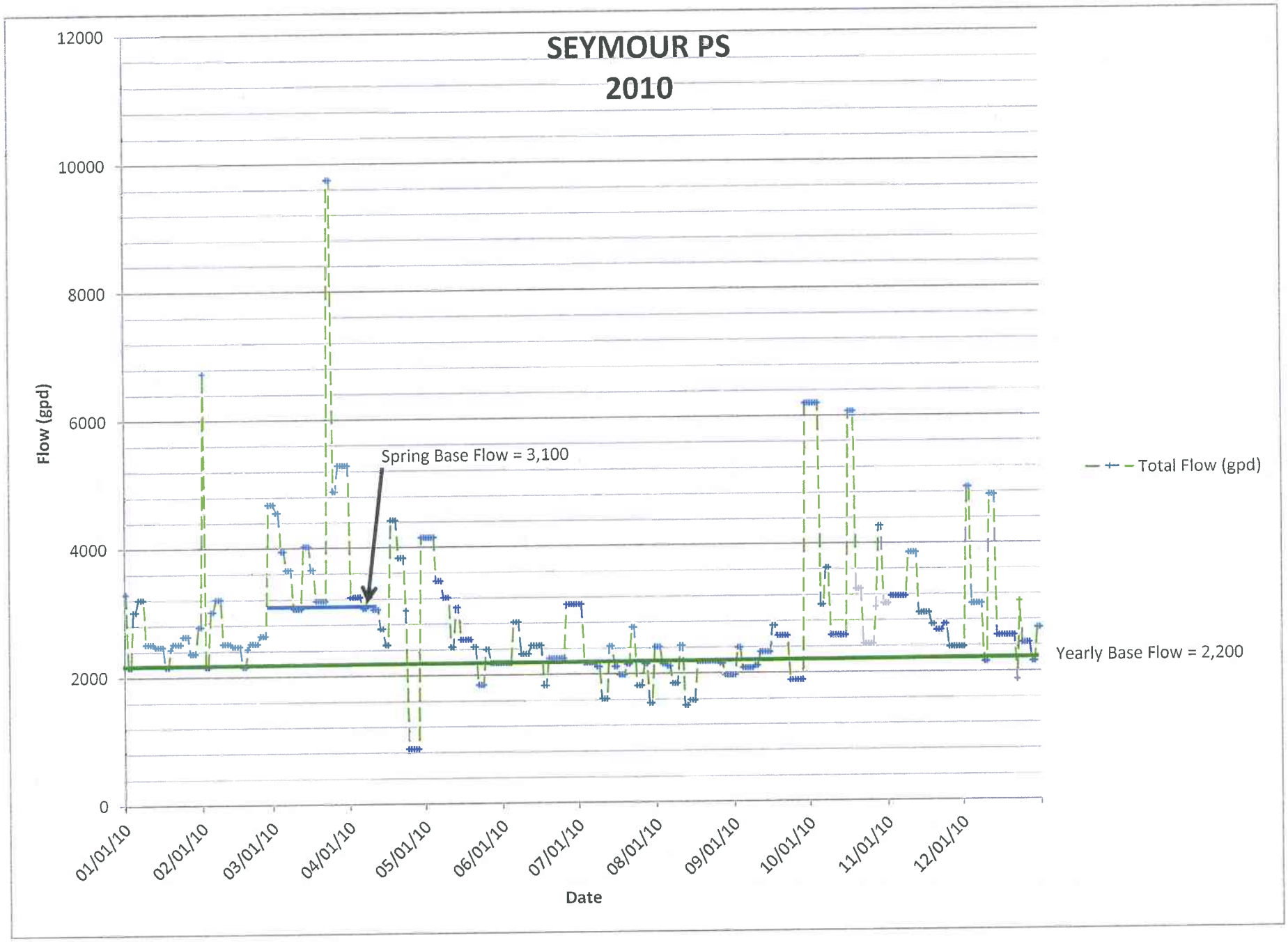

SEMINARY PS
2011
300000
250000
200000
150000
100000
50000
0
Flow (gpd)
Spring Base Flow = 50,000
Total Flow (gpd)
Yearly Base Flow = 25,000
01/01/11
02/01/11
03/01/11
04/01/11
05/01/11
06/01/11
07/01/11
08/01/11
09/01/11
10/01/11
11/01/11
12/01/11
Date

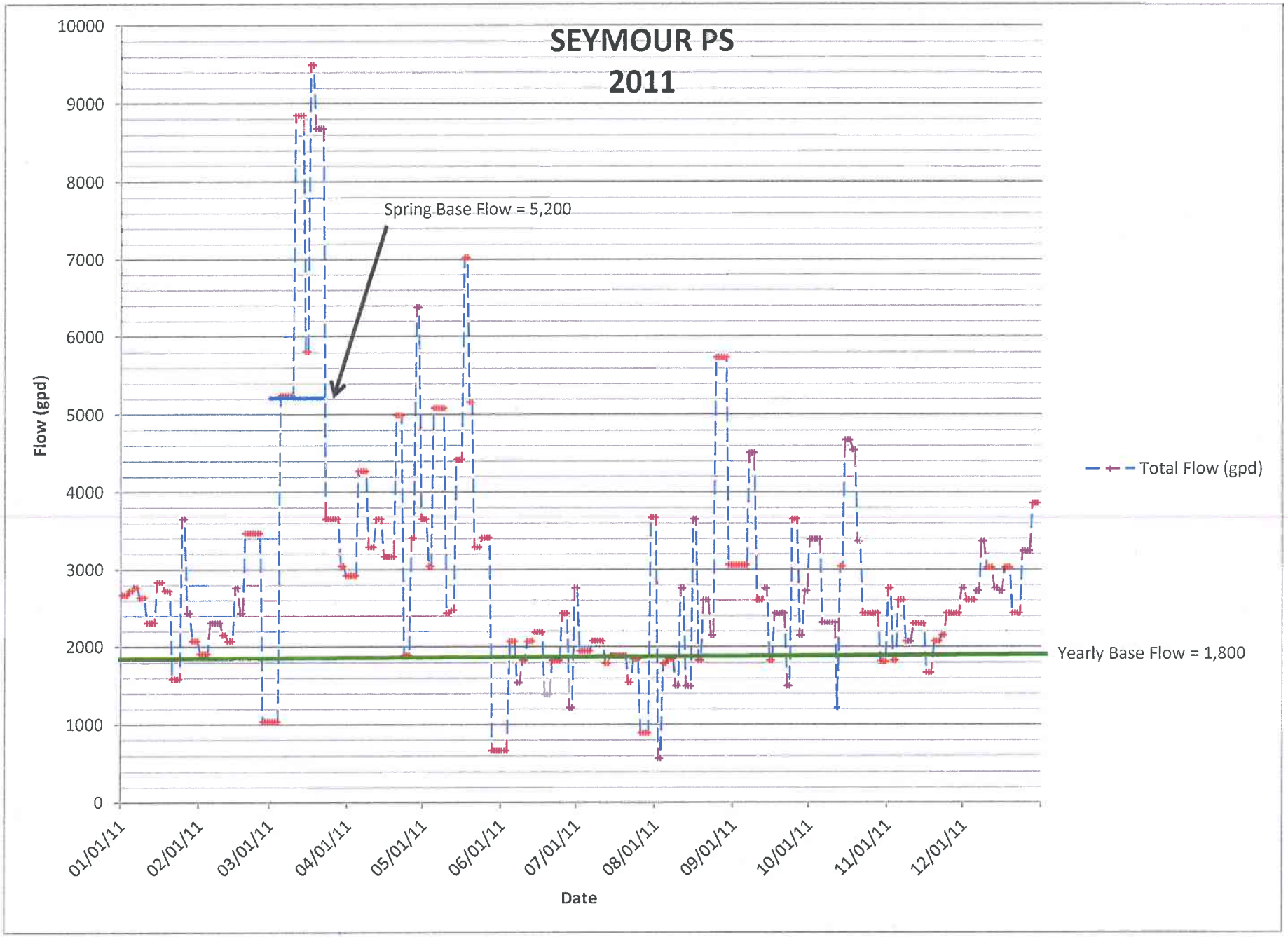

ROGERS PS
2009
Spring Base Flow = 100,000
Yearly Base Flow = 65,000
Gravity Flow (gpd)
Flow (gpd)
Date
300000
250000
200000
150000
100000
50000
0
01/01/09
02/01/09
03/01/09
04/01/09
05/01/09
06/01/09
07/01/09
08/01/09
09/01/09
10/01/09
11/01/09
12/01/09

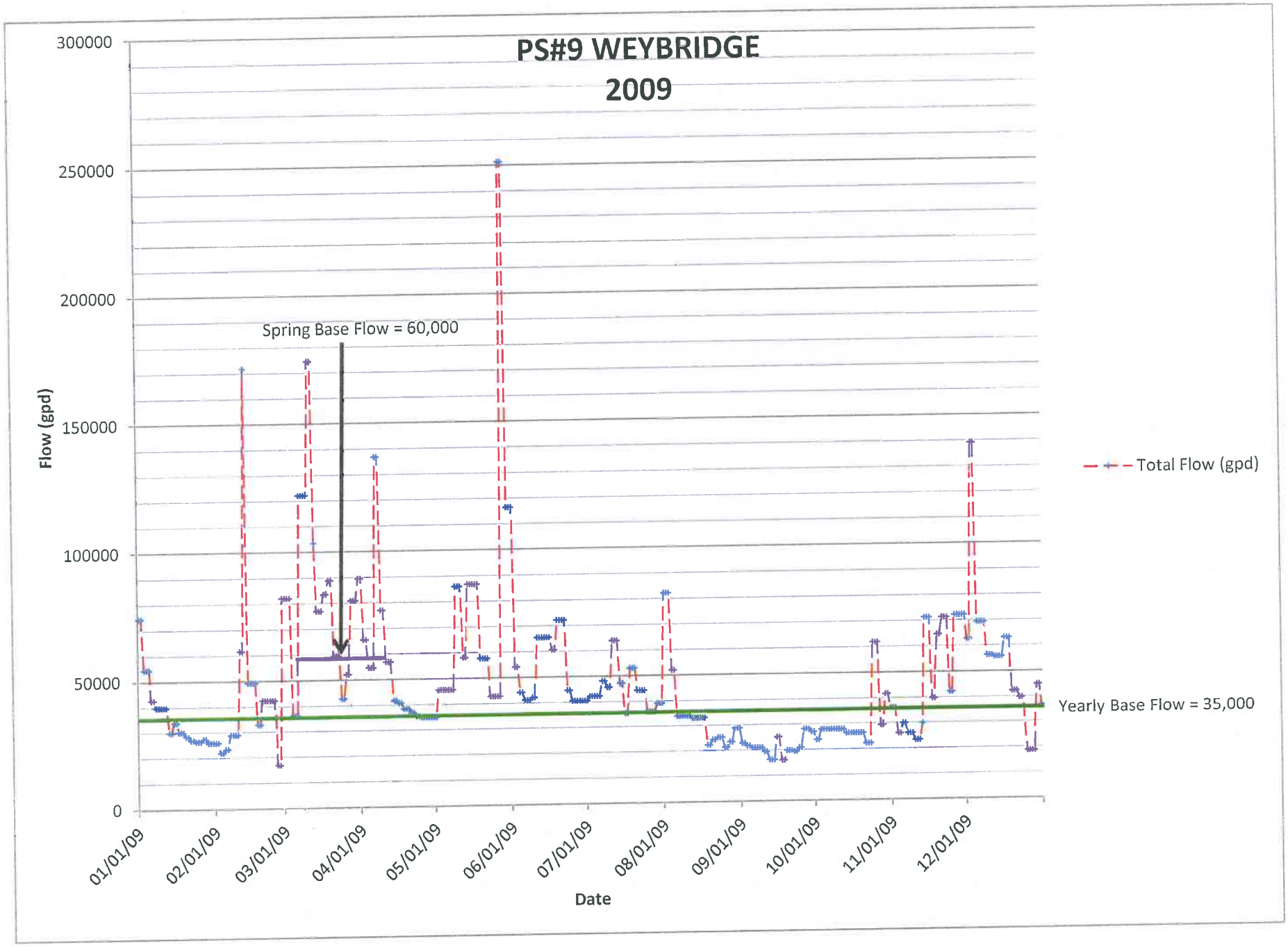

ROGERS PS
2010
400000
350000
300000
250000
200000
150000
100000
50000
0
Flow (gpd)
Spring Base Flow = 120,000
Yearly Base Flow = 80,000
Gravity Flow (gpd)
01/01/10
02/01/10
03/01/10
04/01/10
05/01/10
06/01/10
07/01/10
08/01/10
09/01/10
10/01/10
11/01/10
12/01/10
Date

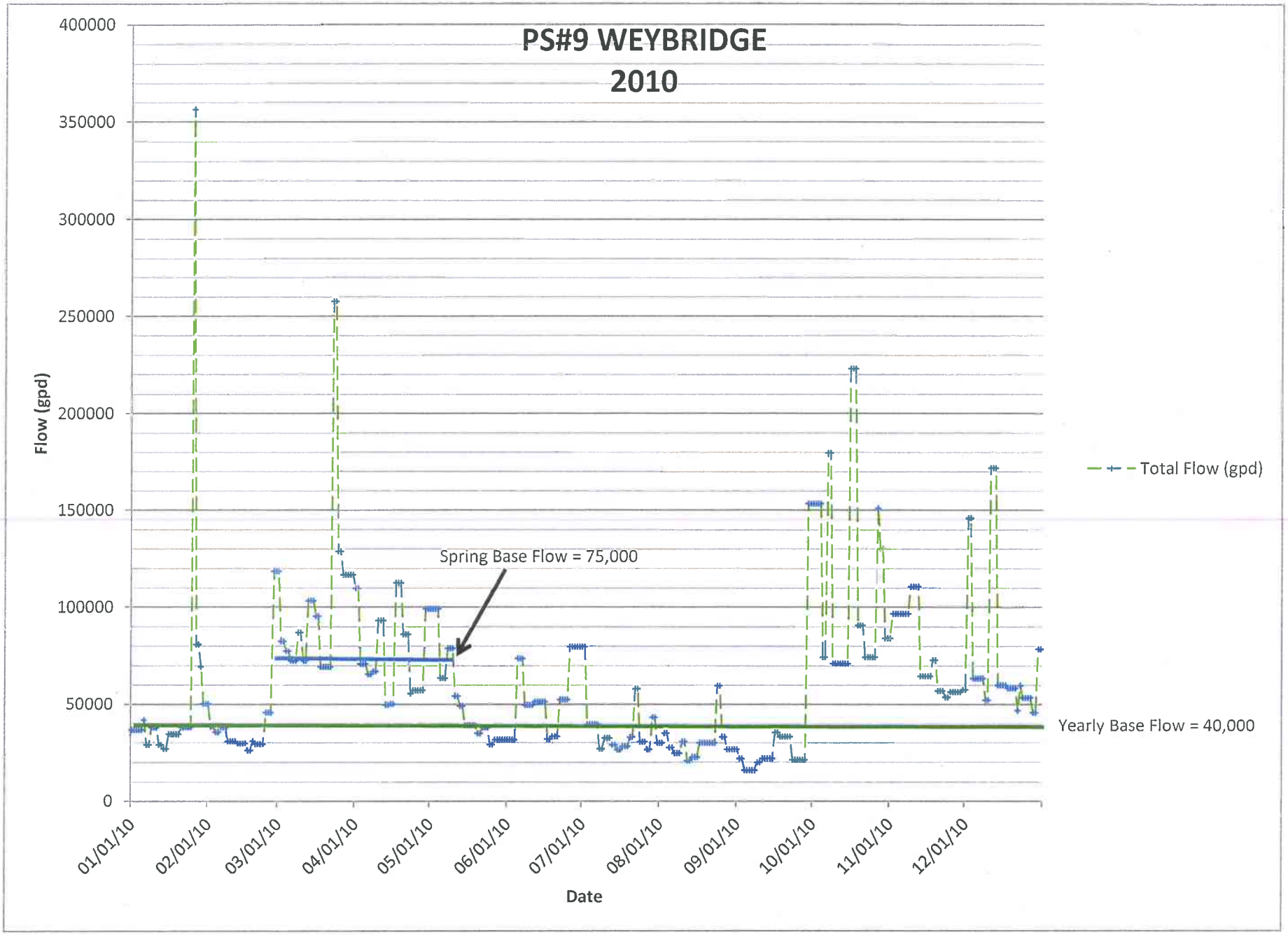

ROGERS PS
2011
Spring Base Flow = 220,000
Yearly Base Flow = 80,000
Gravity Flow (gpd)
Flow (gpd)
Date
700000
600000
500000
400000
300000
200000
100000
0
01/01/11
02/01/11
03/01/11
04/01/11
05/01/11
06/01/11
07/01/11
08/01/11
09/01/11
10/01/11
11/01/11
12/01/11

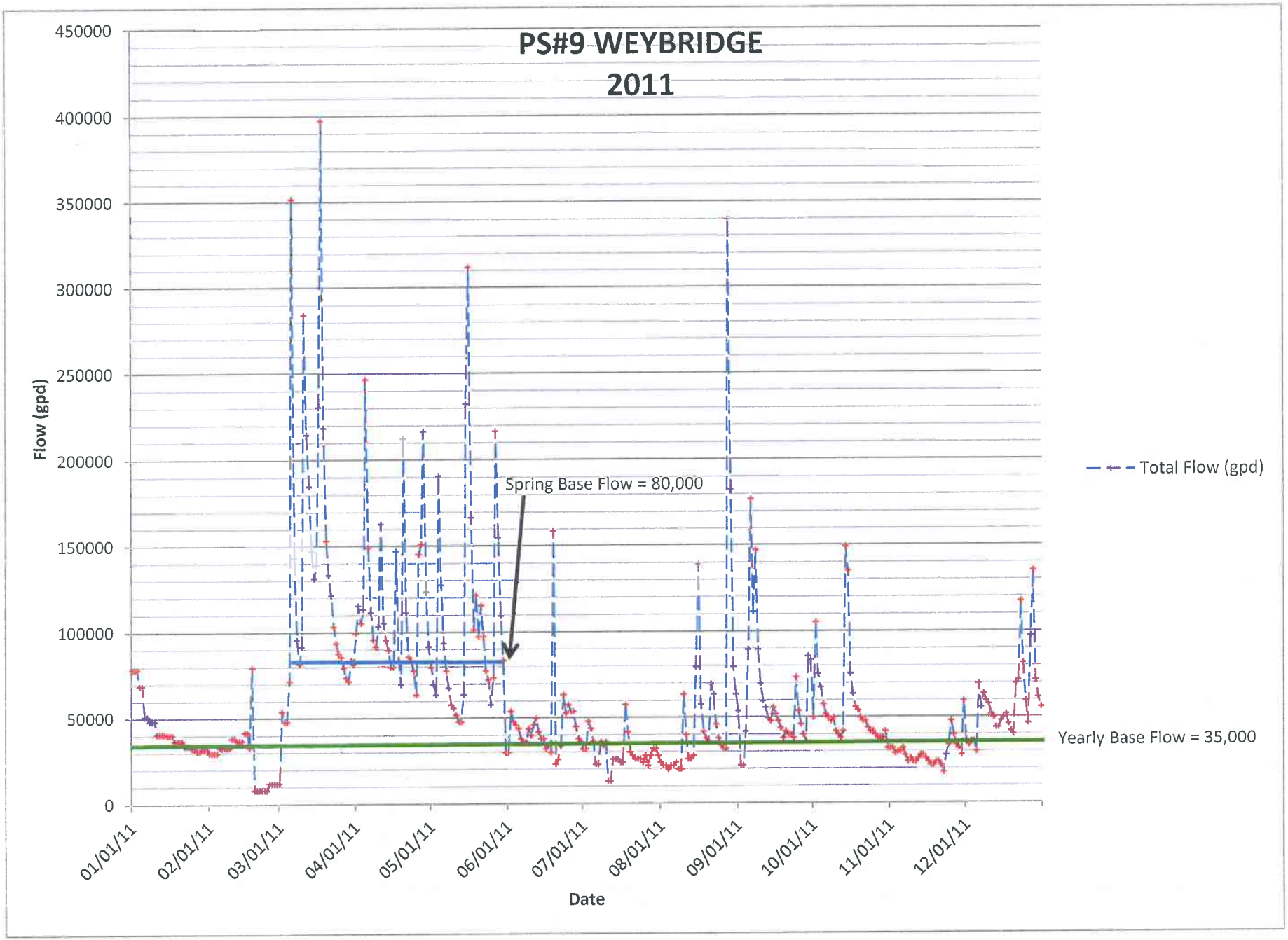

SEYMOUR PS
2009
Flow (gpd)
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
Spring Base Flow = 3,200
Total Flow (gpd)
Yearly Base Flow = 2,200
01/01/09
02/01/09
03/01/09
04/01/09
05/01/09
06/01/09
07/01/09
08/01/09
09/01/09
10/01/09
11/01/09
12/01/09
Date

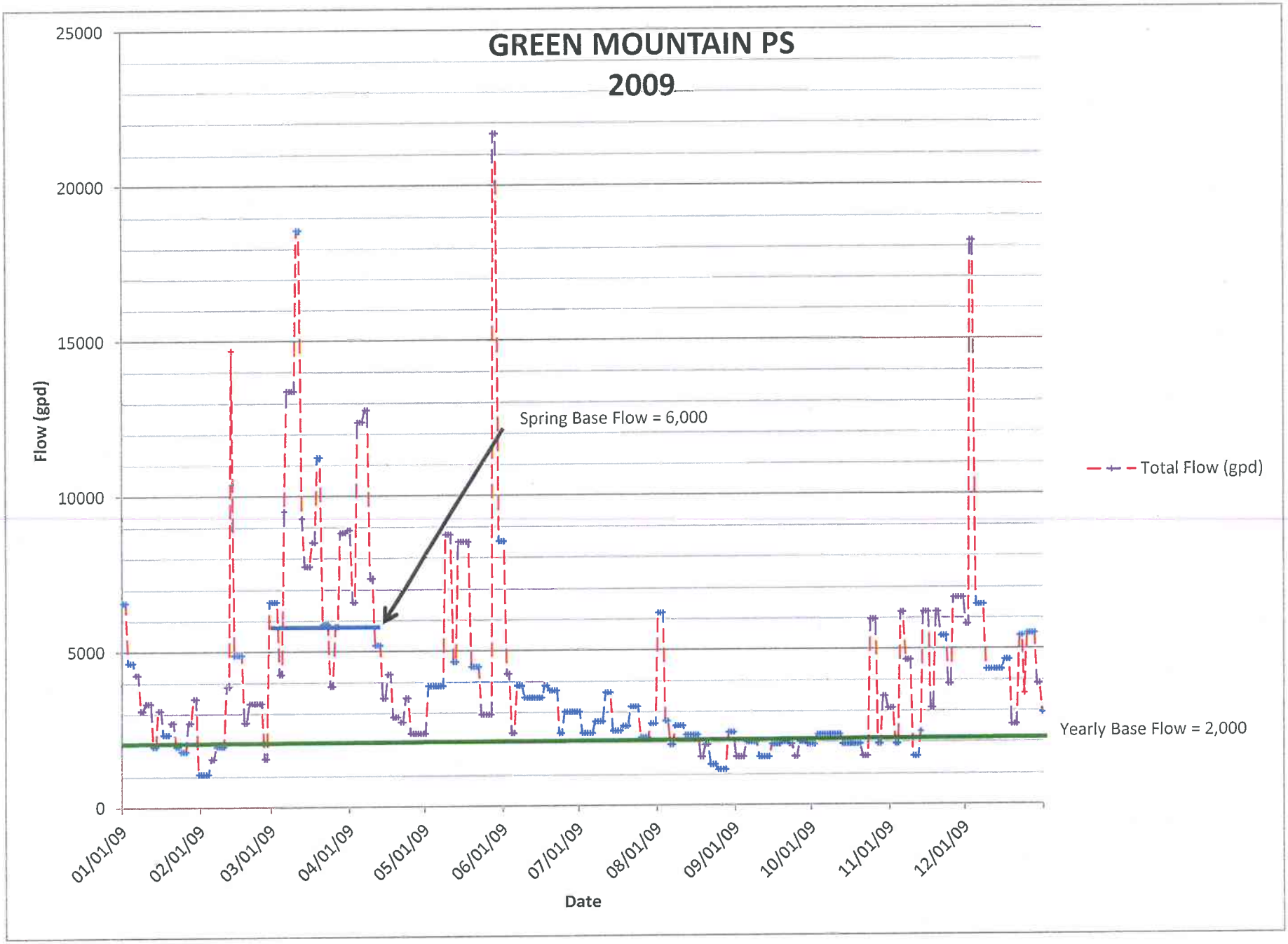

SEYMOUR PS
2010
12000
10000
8000
6000
4000
2000
0
Flow (gpd)
Spring Base Flow = 3,100
Yearly Base Flow = 2,200
Total Flow (gpd)
01/01/10
02/01/10
03/01/10
04/01/10
05/01/10
06/01/10
07/01/10
08/01/10
09/01/10
10/01/10
11/01/10
12/01/10
Date

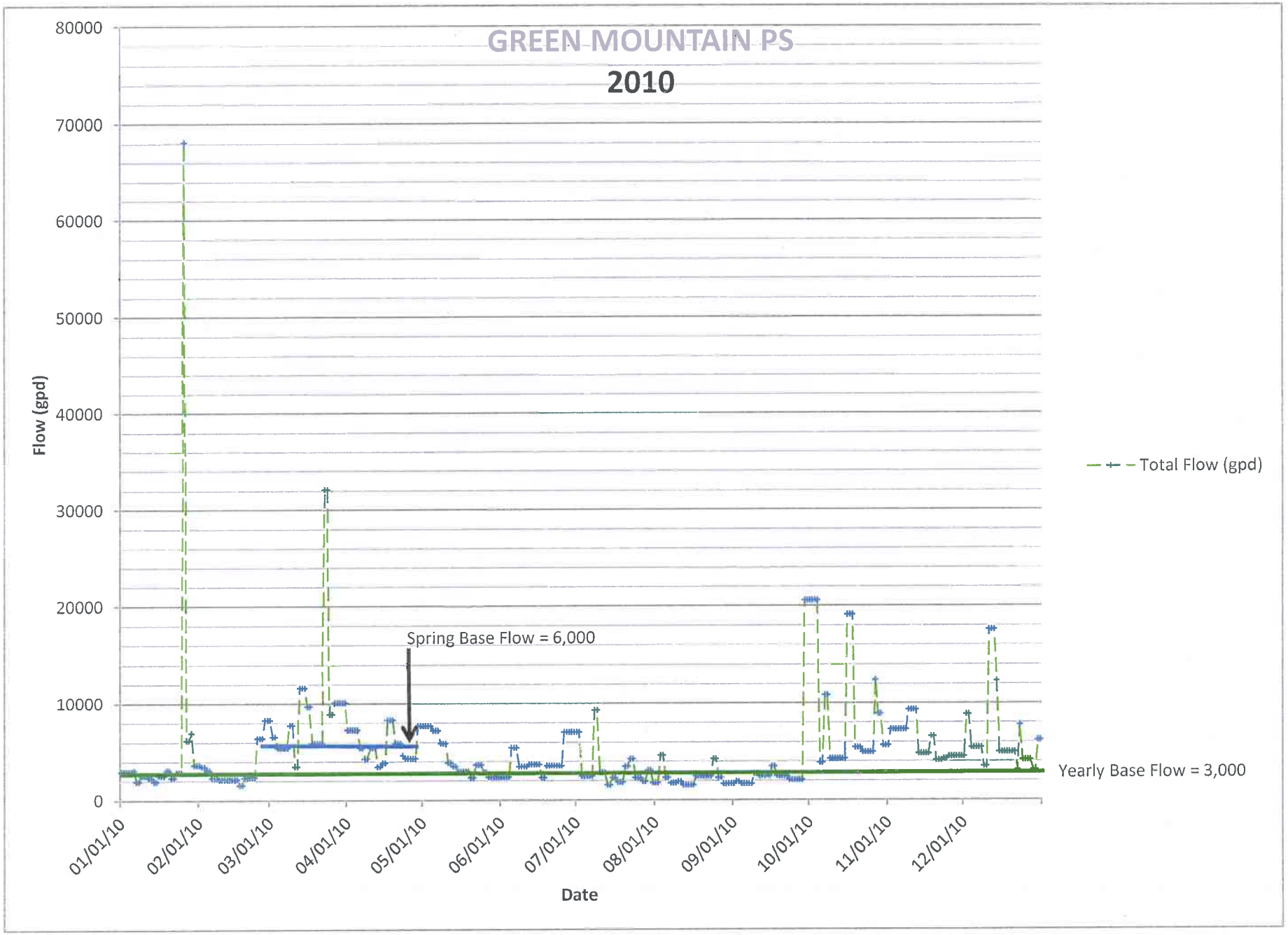

SEYMOUR PS
2011
Spring Base Flow = 5,200
Yearly Base Flow = 1,800
Total Flow (gpd)
Flow (gpd)
Date
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
01/01/11
02/01/11
03/01/11
04/01/11
05/01/11
06/01/11
07/01/11
08/01/11
09/01/11
10/01/11
11/01/11
12/01/11

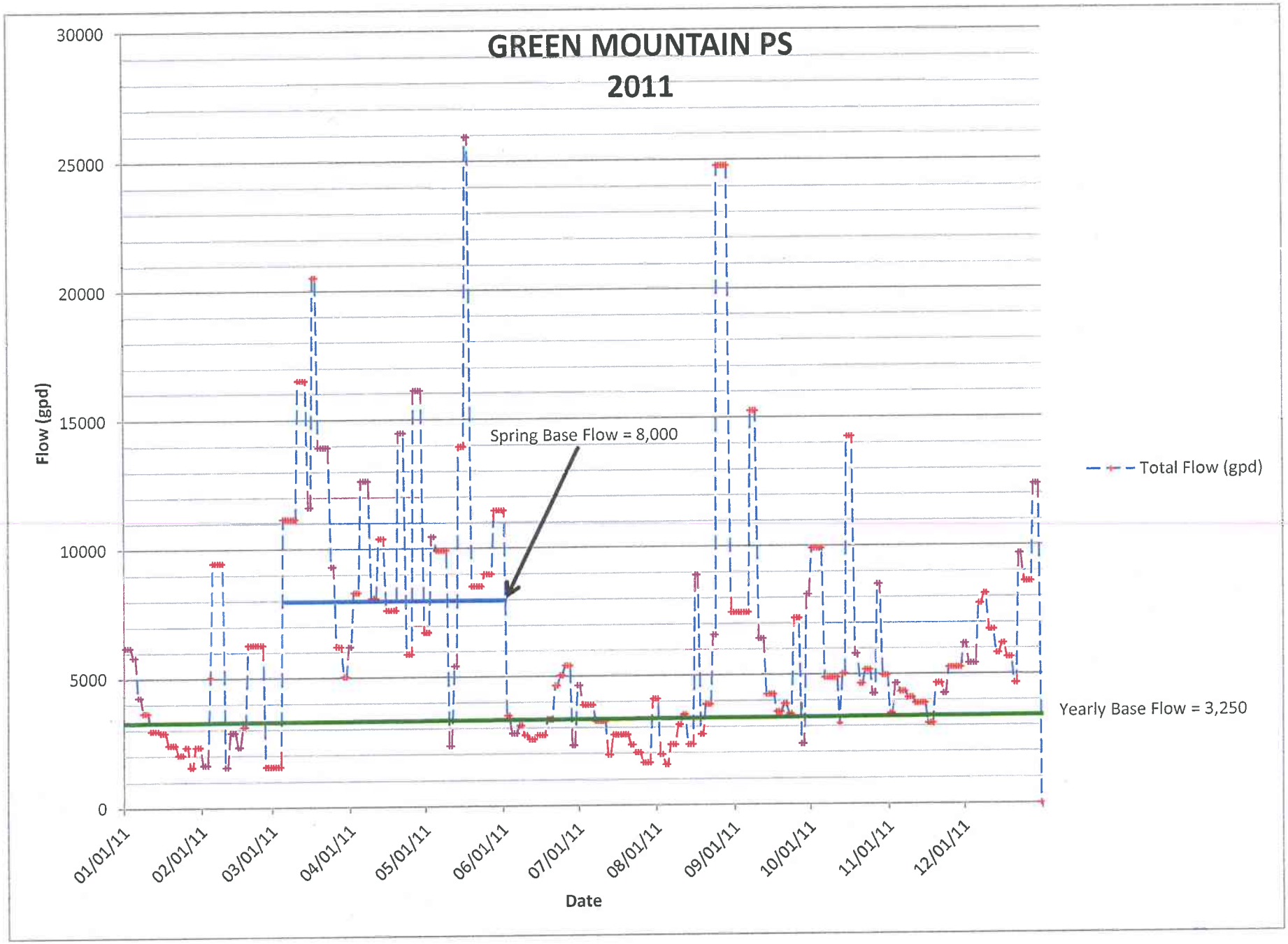

PS#9 WEYBRIDGE
2009
300000
250000
200000
150000
100000
50000
0
Flow (gpd)
Spring Base Flow = 60,000
Total Flow (gpd)
Yearly Base Flow = 35,000
01/01/09
02/01/09
03/01/09
04/01/09
05/01/09
06/01/09
07/01/09
08/01/09
09/01/09
10/01/09
11/01/09
12/01/09
Date

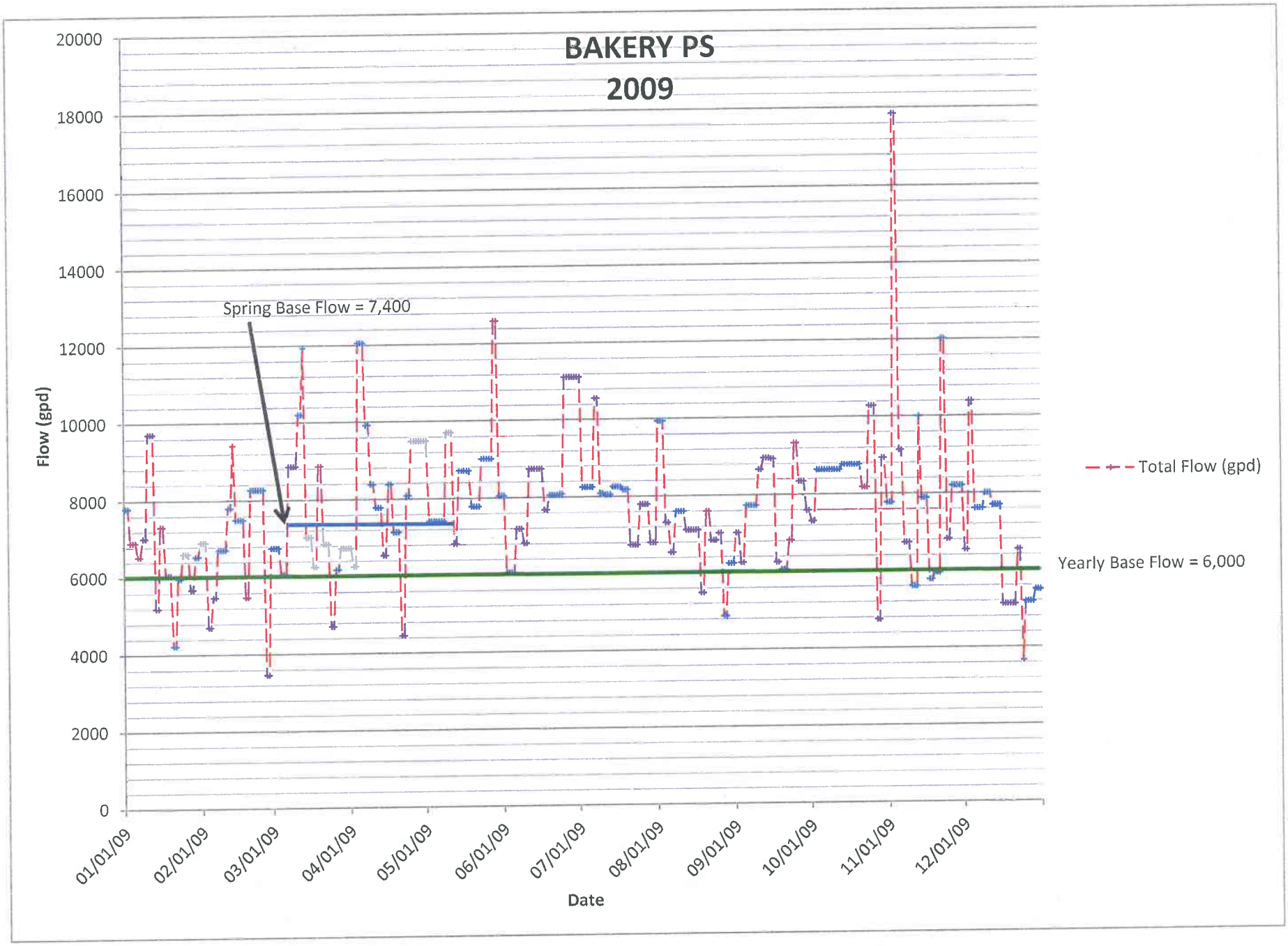

PS#9 WEYBRIDGE
2010
400000
350000
300000
250000
200000
150000
100000
50000
0
Flow (gpd)
Spring Base Flow = 75,000
Yearly Base Flow = 40,000
Total Flow (gpd)
01/01/10
02/01/10
03/01/10
04/01/10
05/01/10
06/01/10
07/01/10
08/01/10
09/01/10
10/01/10
11/01/10
12/01/10
Date

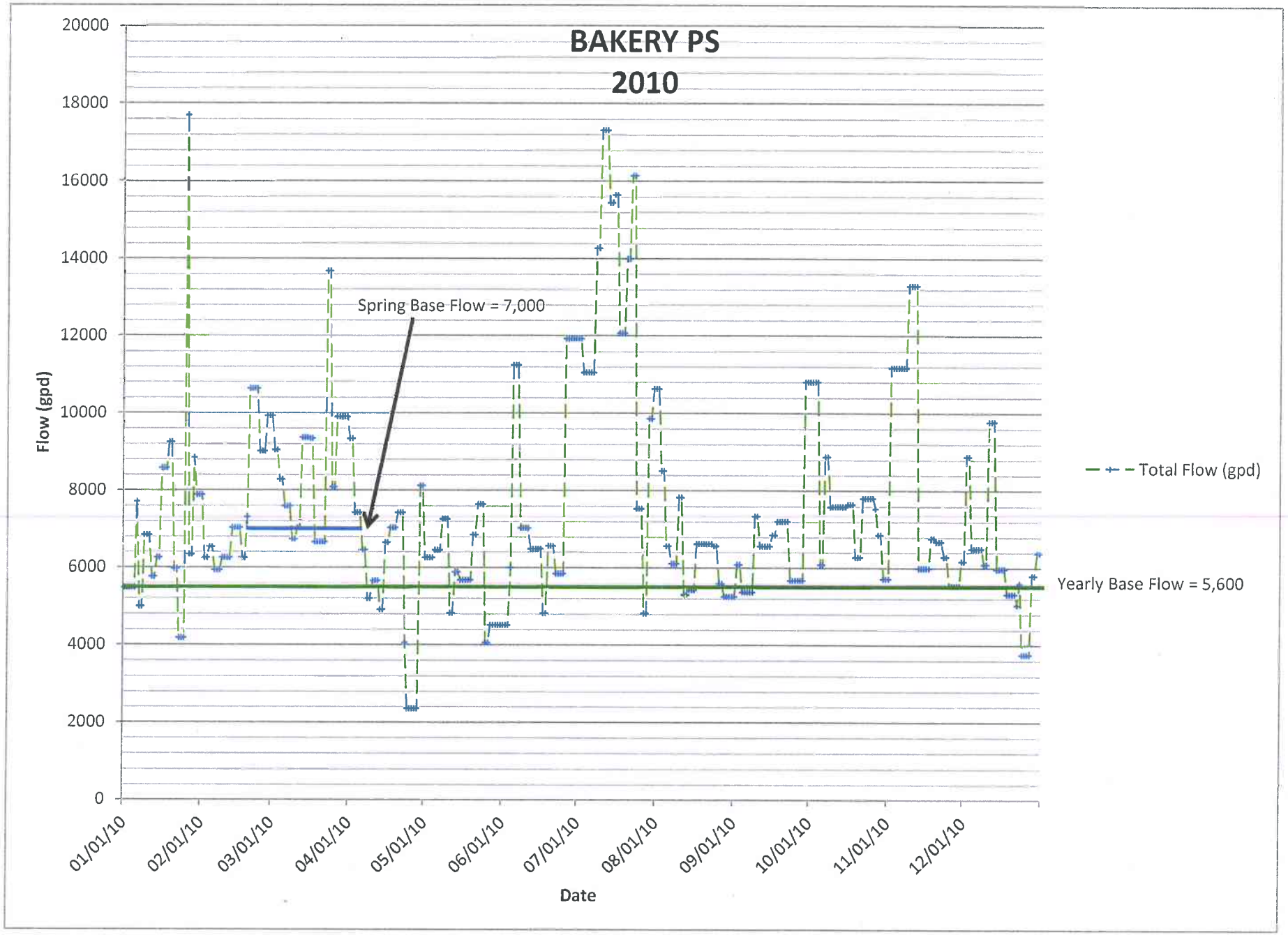

PS#9 WEYBRIDGE
2011
Flow (gpd)
450000
400000
350000
300000
250000
200000
150000
100000
50000
0
Spring Base Flow = 80,000
Yearly Base Flow = 35,000
Total Flow (gpd)
01/01/11
02/01/11
03/01/11
04/01/11
05/01/11
06/01/11
07/01/11
08/01/11
09/01/11
10/01/11
11/01/11
12/01/11
Date

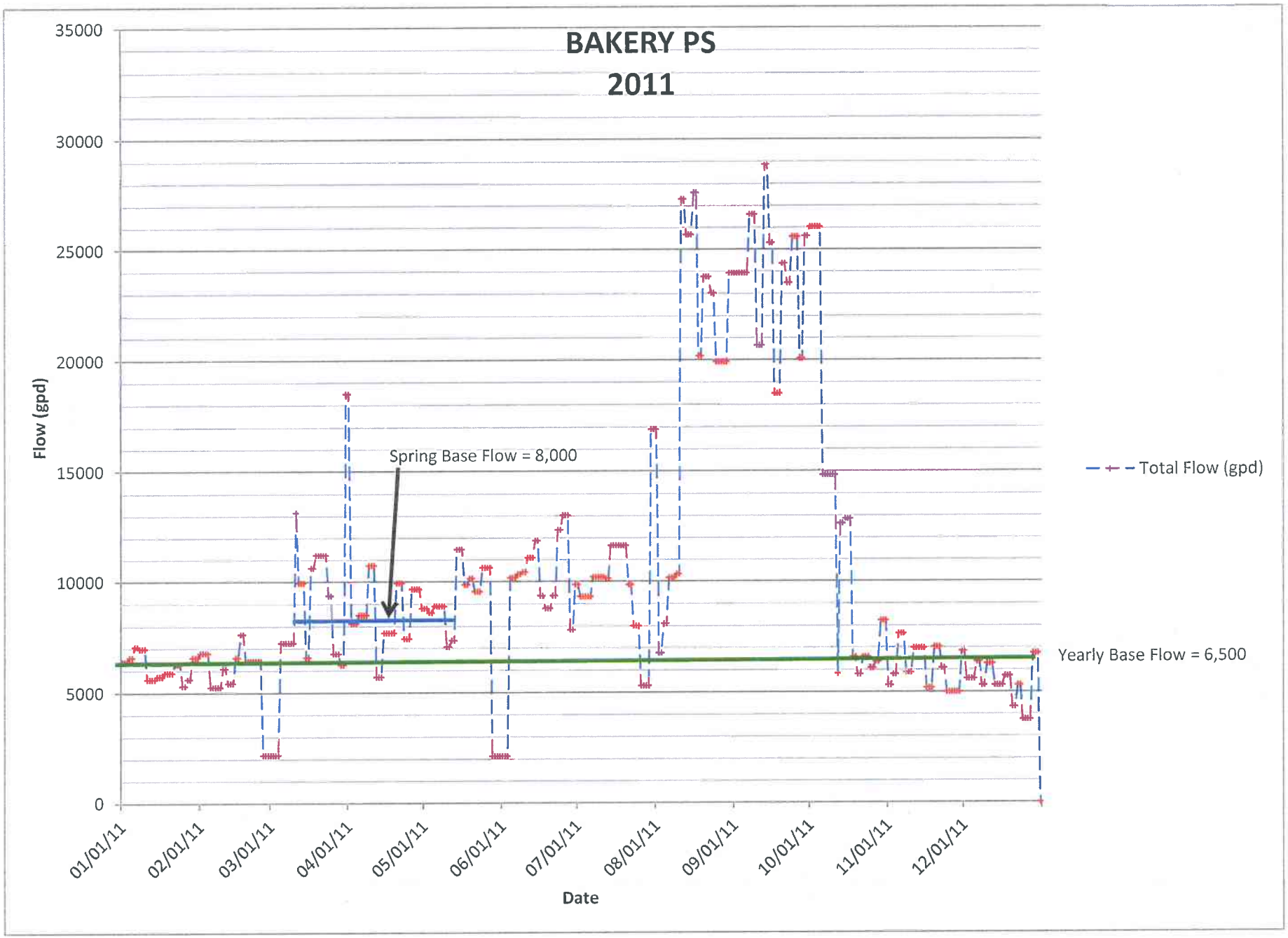

GREEN MOUNTAIN PS
2009
25000
20000
15000
10000
5000
0
Flow (gpd)
Spring Base Flow = 6,000
Total Flow (gpd)
Yearly Base Flow = 2,000
01/01/09
02/01/09
03/01/09
04/01/09
05/01/09
06/01/09
07/01/09
08/01/09
09/01/09
10/01/09
11/01/09
12/01/09
Date

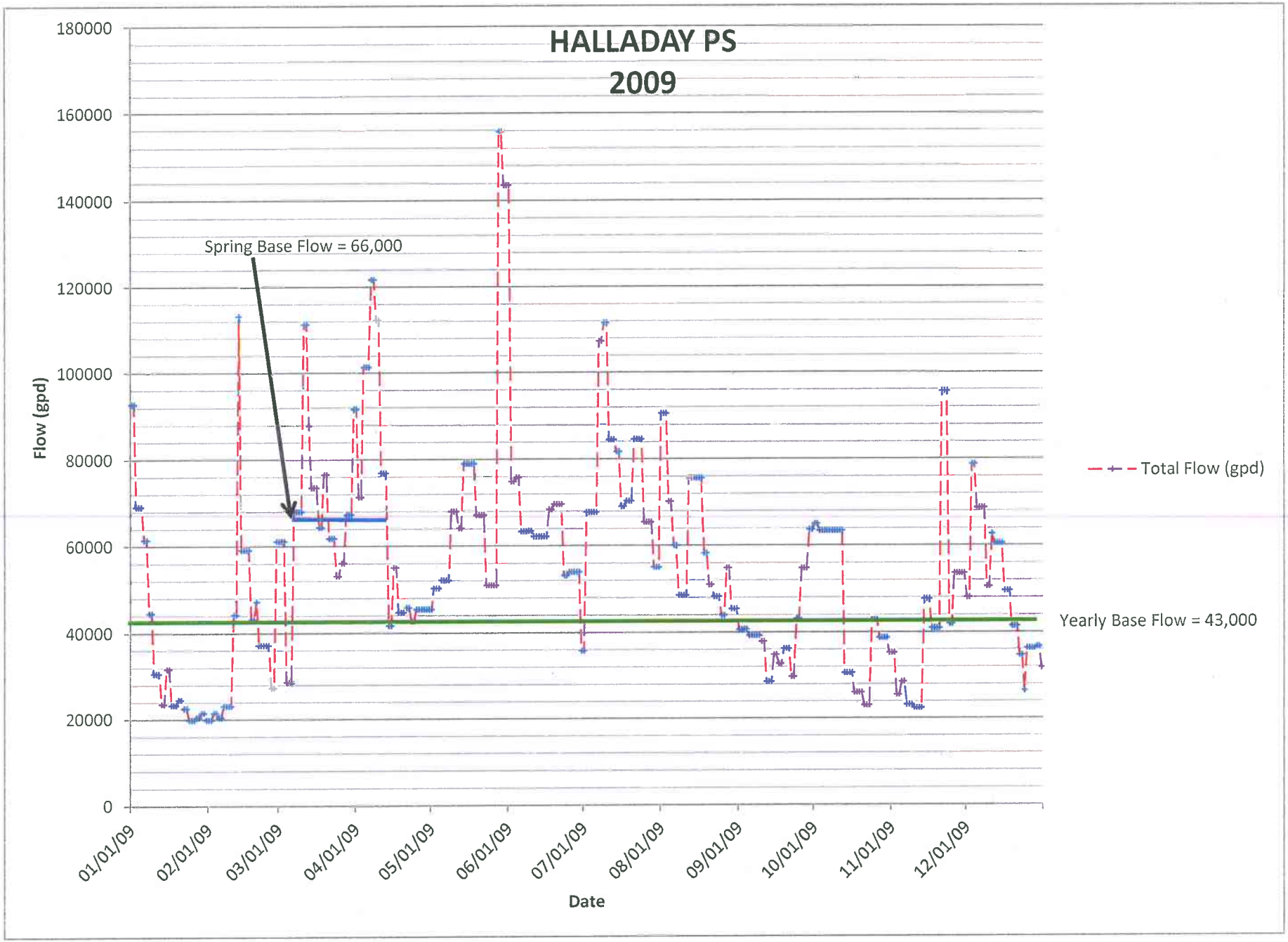

GREEN MOUNTAIN PS
2010
80000
70000
60000
50000
40000
30000
20000
10000
0
Flow (gpd)
Spring Base Flow = 6,000
Yearly Base Flow = 3,000
Total Flow (gpd)
01/01/10
02/01/10
03/01/10
04/01/10
05/01/10
06/01/10
07/01/10
08/01/10
09/01/10
10/01/10
11/01/10
12/01/10
Date

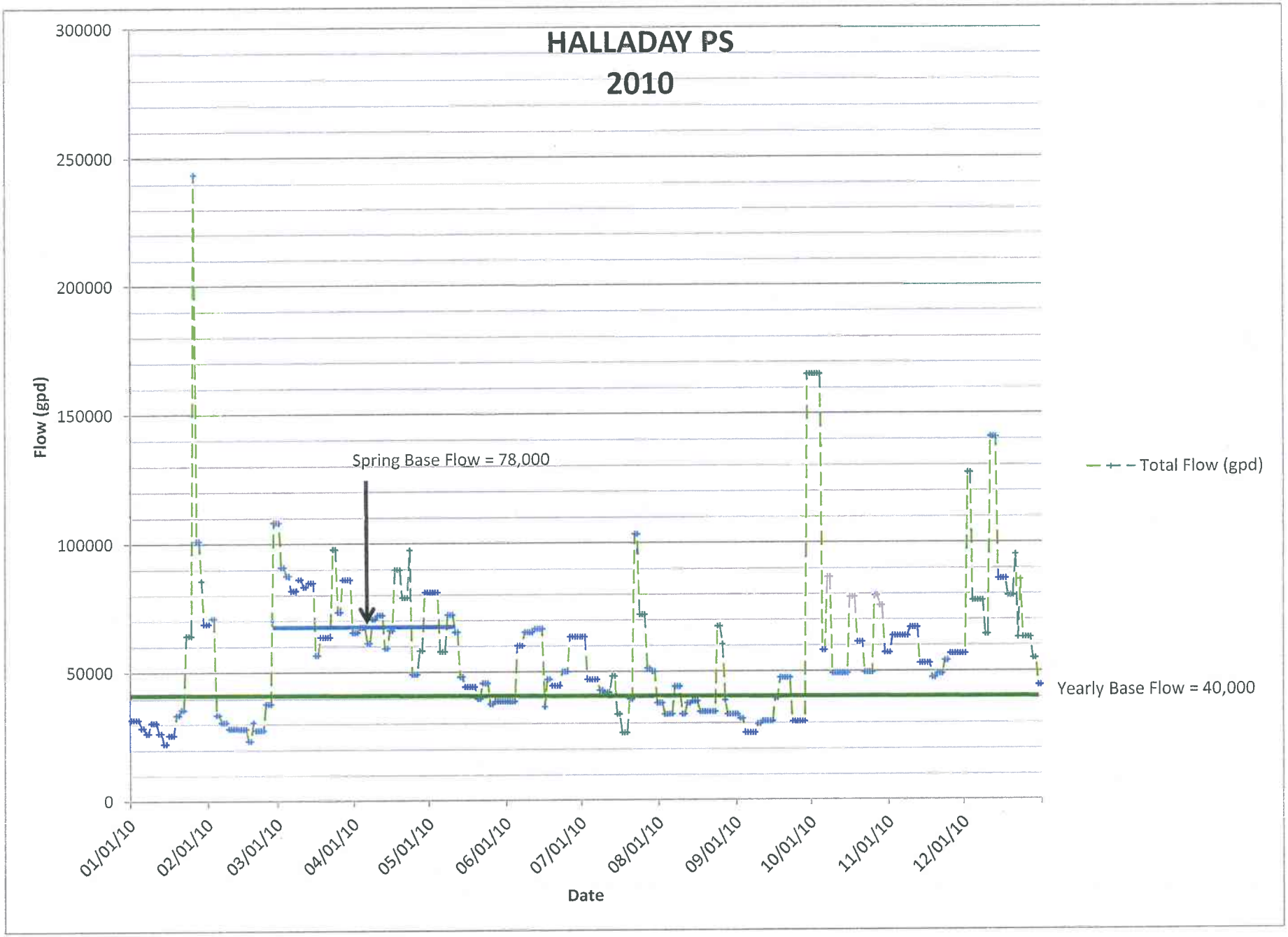

GREEN MOUNTAIN PS
2011
30000
25000
20000
15000
10000
5000
0
Flow (gpd)
Spring Base Flow = 8,000
Total Flow (gpd)
Yearly Base Flow = 3,250
01/01/11
02/01/11
03/01/11
04/01/11
05/01/11
06/01/11
07/01/11
08/01/11
09/01/11
10/01/11
11/01/11
12/01/11
Date

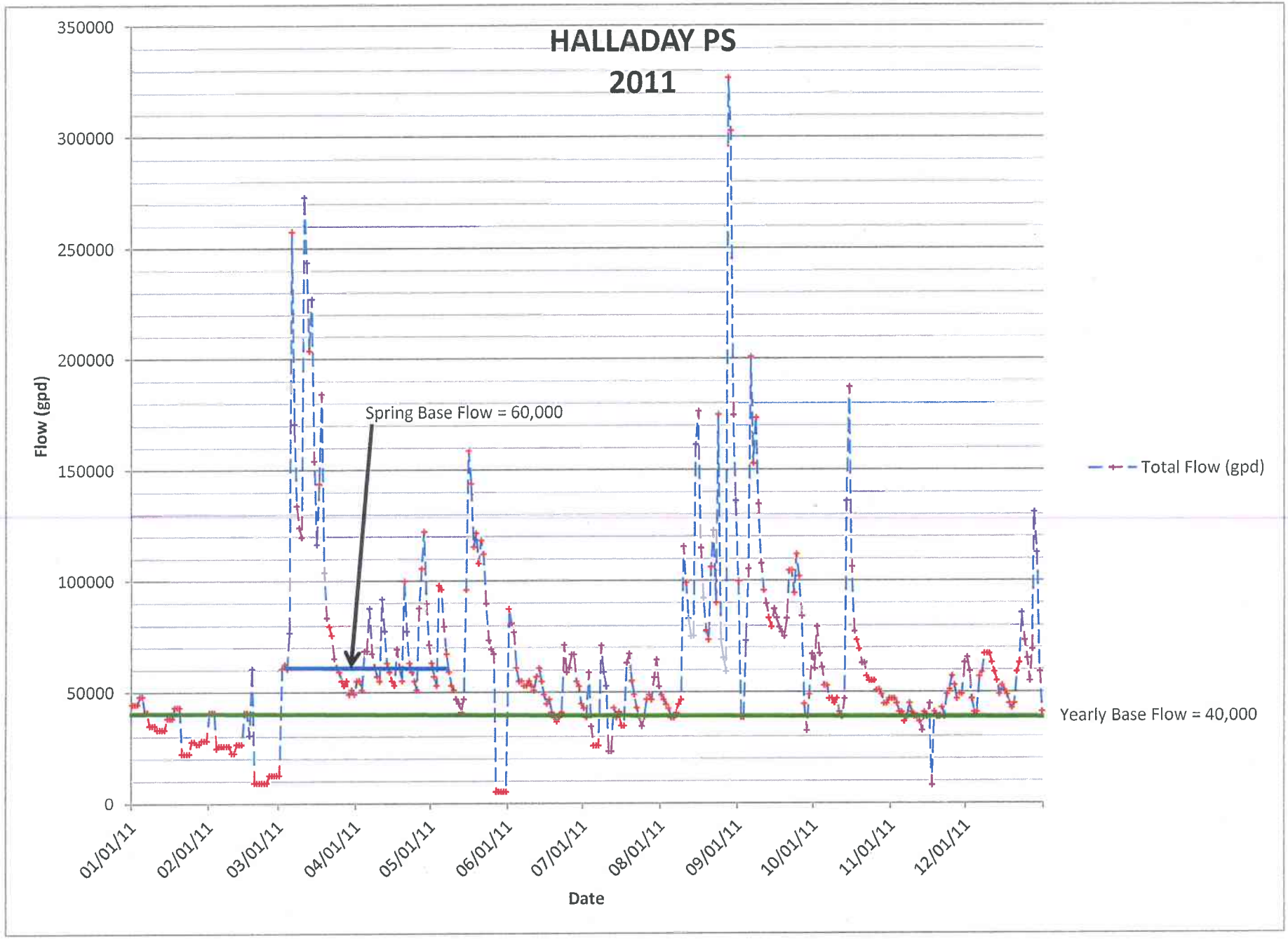

BAKERY PS
2009
Spring Base Flow = 7,400
Yearly Base Flow = 6,000
Total Flow (gpd)
Flow (gpd)
Date
20000
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
01/01/09
02/01/09
03/01/09
04/01/09
05/01/09
06/01/09
07/01/09
08/01/09
09/01/09
10/01/09
11/01/09
12/01/09

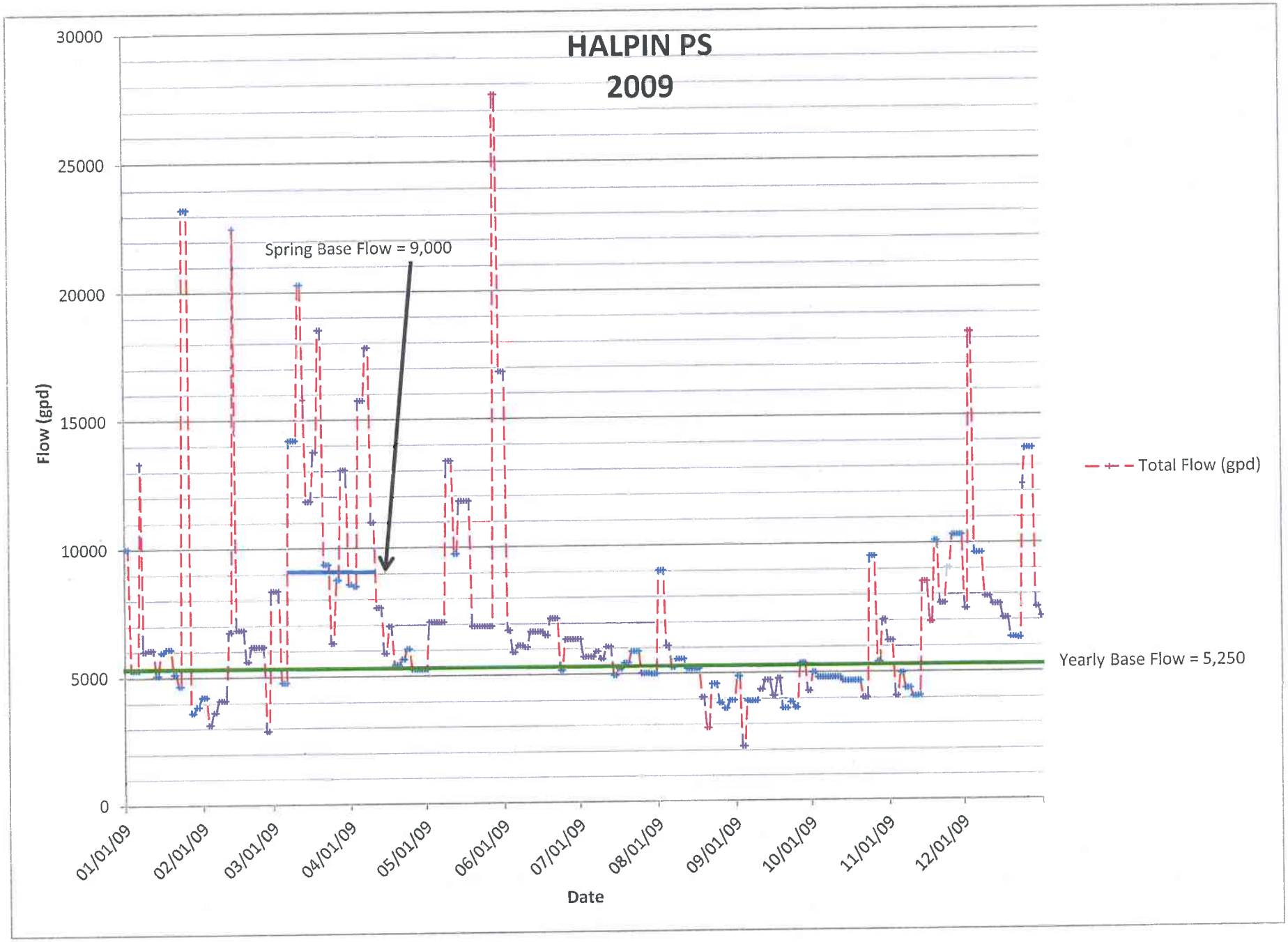

BAKERY PS
2010
Flow (gpd)
20000
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
Spring Base Flow = 7,000
Yearly Base Flow = 5,600
Total Flow (gpd)
01/01/10
02/01/10
03/01/10
04/01/10
05/01/10
06/01/10
07/01/10
08/01/10
09/01/10
10/01/10
11/01/10
12/01/10
Date

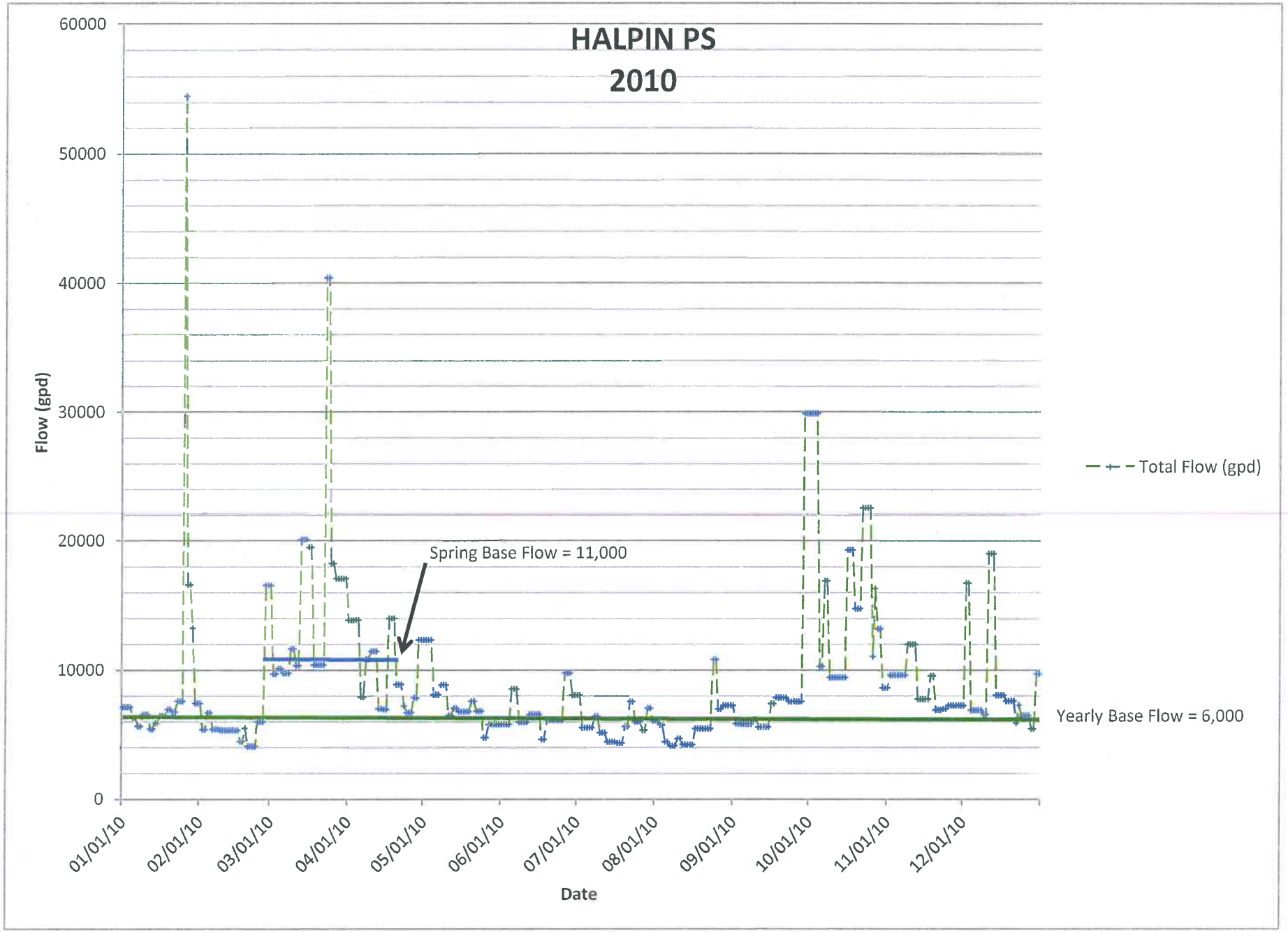

BAKERY PS
2011
35000
30000
25000
20000
15000
10000
5000
0
Flow (gpd)
Spring Base Flow = 8,000
Total Flow (gpd)
Yearly Base Flow = 6,500
01/01/11
02/01/11
03/01/11
04/01/11
05/01/11
06/01/11
07/01/11
08/01/11
09/01/11
10/01/11
11/01/11
12/01/11
Date

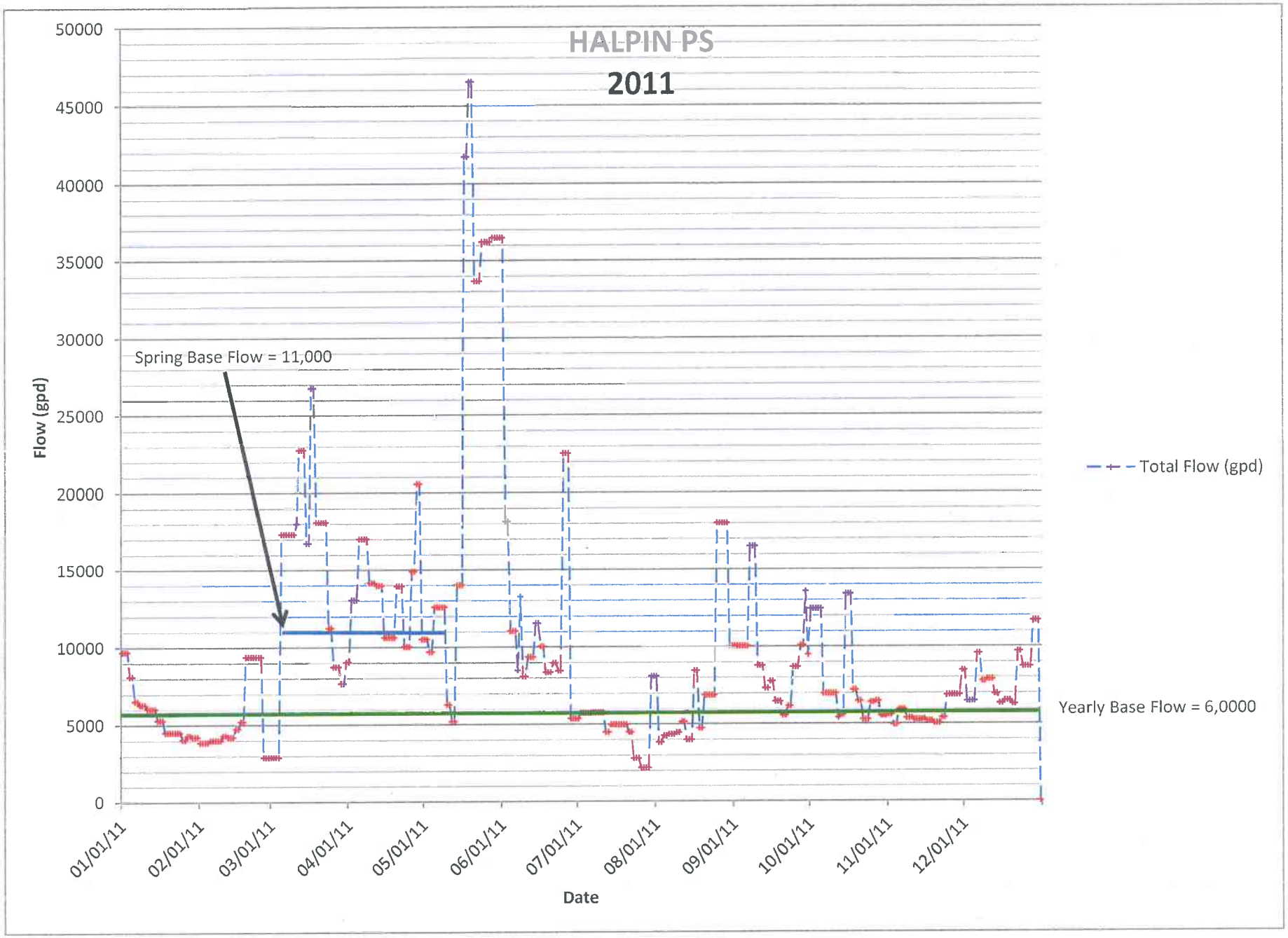

HALLADAY PS
2009
Spring Base Flow = 66,000
Yearly Base Flow = 43,000
Total Flow (gpd)
Flow (gpd)
Date
180000
160000
140000
120000
100000
80000
60000
40000
20000
0
01/01/09
02/01/09
03/01/09
04/01/09
05/01/09
06/01/09
07/01/09
08/01/09
09/01/09
10/01/09
11/01/09
12/01/09

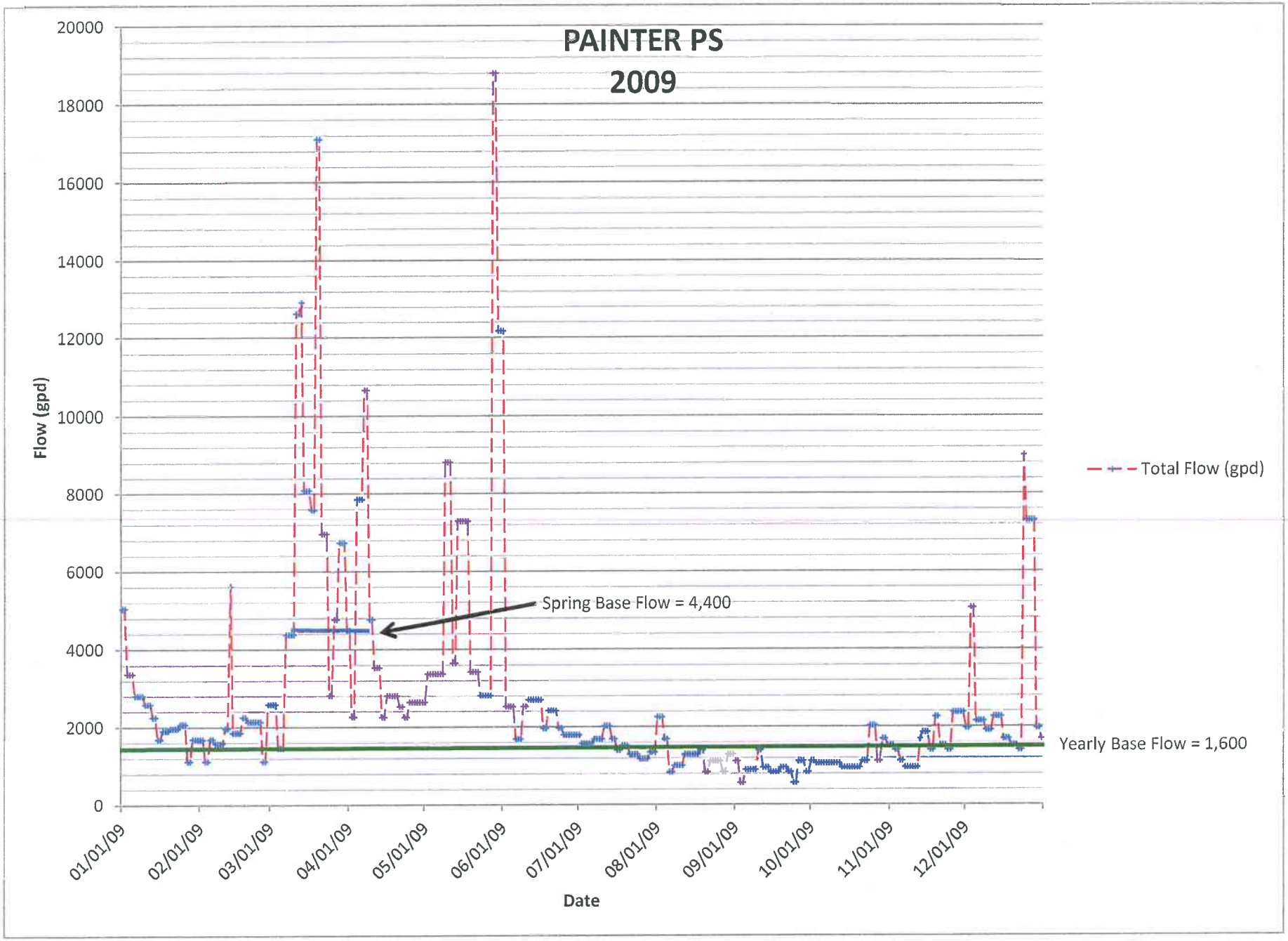

HALLADAY PS
2010
300000
250000
200000
150000
100000
50000
0
Flow (gpd)
Spring Base Flow = 78,000
Total Flow (gpd)
Yearly Base Flow = 40,000
01/01/10
02/01/10
03/01/10
04/01/10
05/01/10
06/01/10
07/01/10
08/01/10
09/01/10
10/01/10
11/01/10
12/01/10
Date

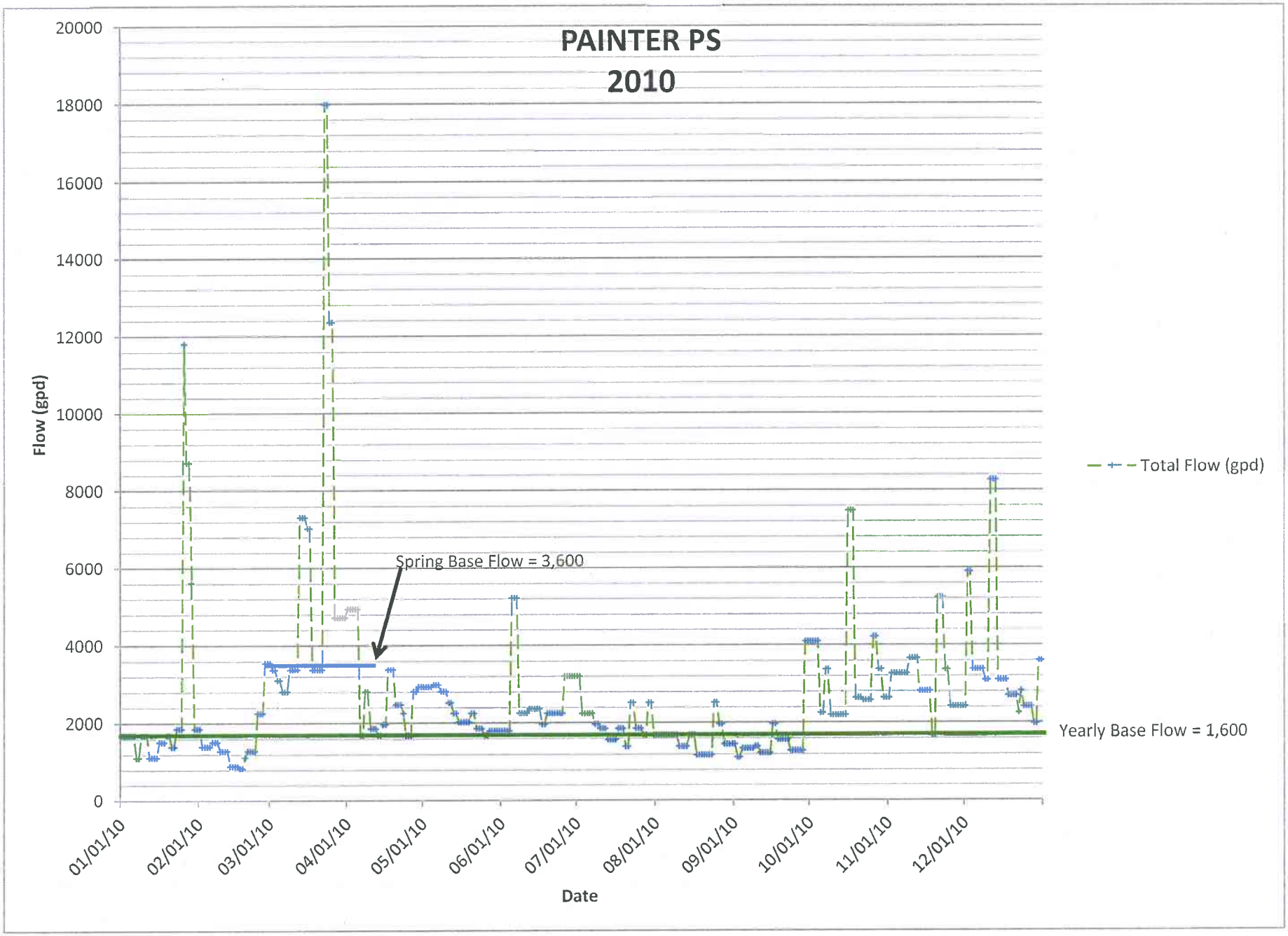

HALLADAY PS
2011
350000
300000
250000
200000
150000
100000
50000
0
Flow (gpd)
Spring Base Flow = 60,000
Yearly Base Flow = 40,000
Total Flow (gpd)
01/01/11
02/01/11
03/01/11
04/01/11
05/01/11
06/01/11
07/01/11
08/01/11
09/01/11
10/01/11
11/01/11
12/01/11
Date

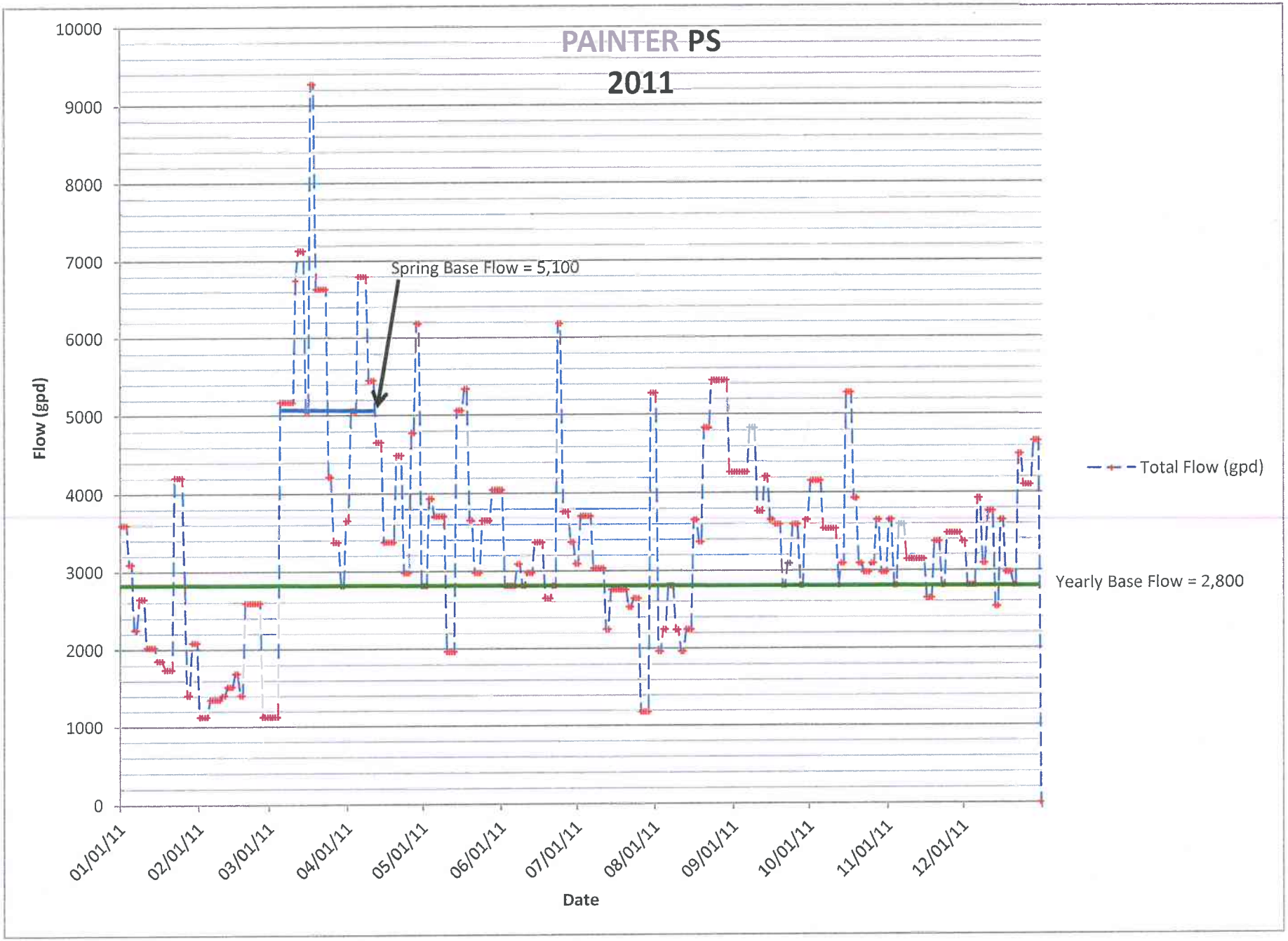

HALPIN PS
2009
Spring Base Flow = 9,000
Yearly Base Flow = 5,250
Total Flow (gpd)
Flow (gpd)
Date
30000
25000
20000
15000
10000
5000
0
01/01/09
02/01/09
03/01/09
04/01/09
05/01/09
06/01/09
07/01/09
08/01/09
09/01/09
10/01/09
11/01/09
12/01/09

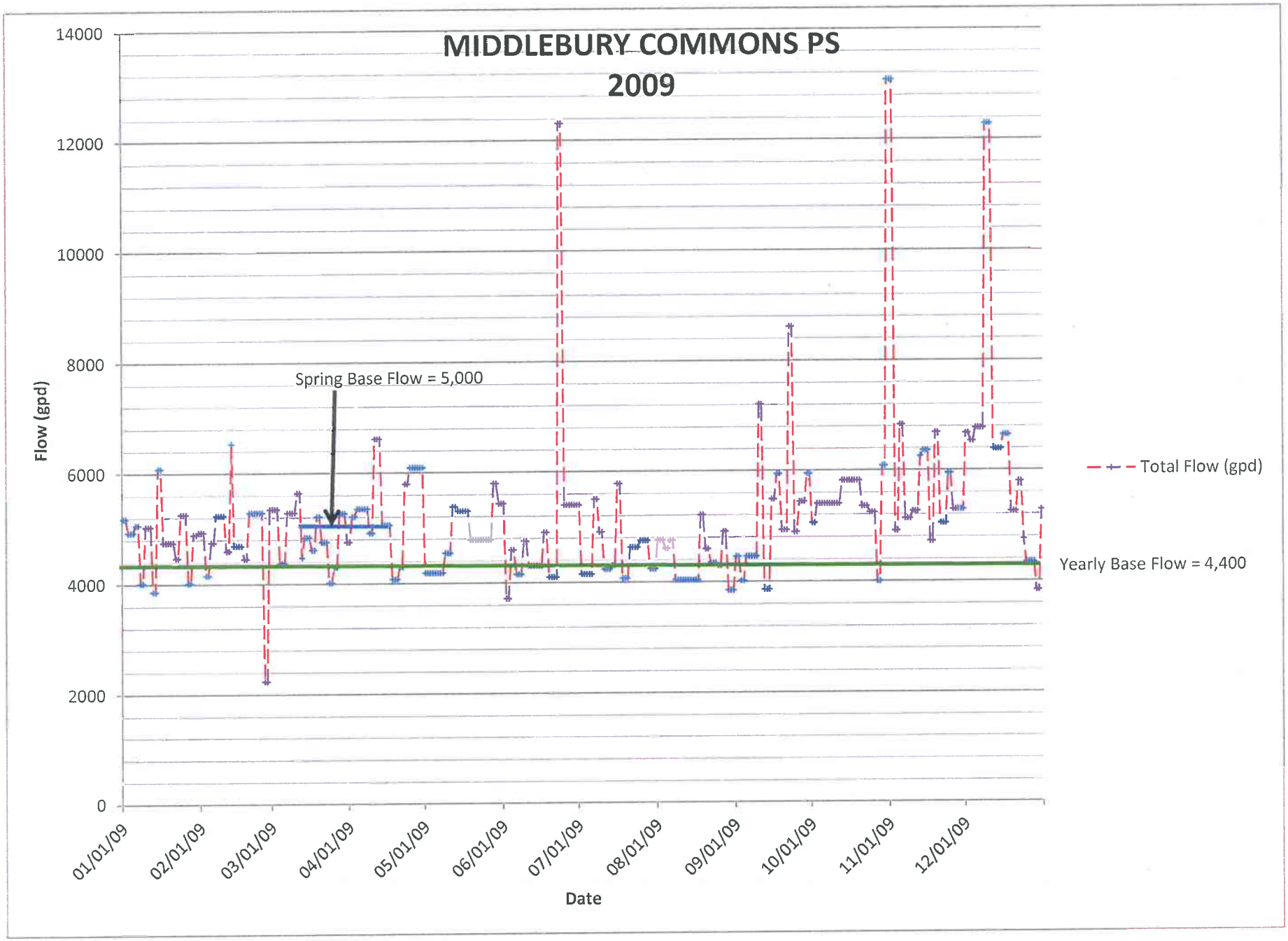

HALPIN PS
2010
60000
50000
40000
30000
20000
10000
0
Flow (gpd)
Spring Base Flow = 11,000
Yearly Base Flow = 6,000
Total Flow (gpd)
01/01/10
02/01/10
03/01/10
04/01/10
05/01/10
06/01/10
07/01/10
08/01/10
09/01/10
10/01/10
11/01/10
12/01/10
Date

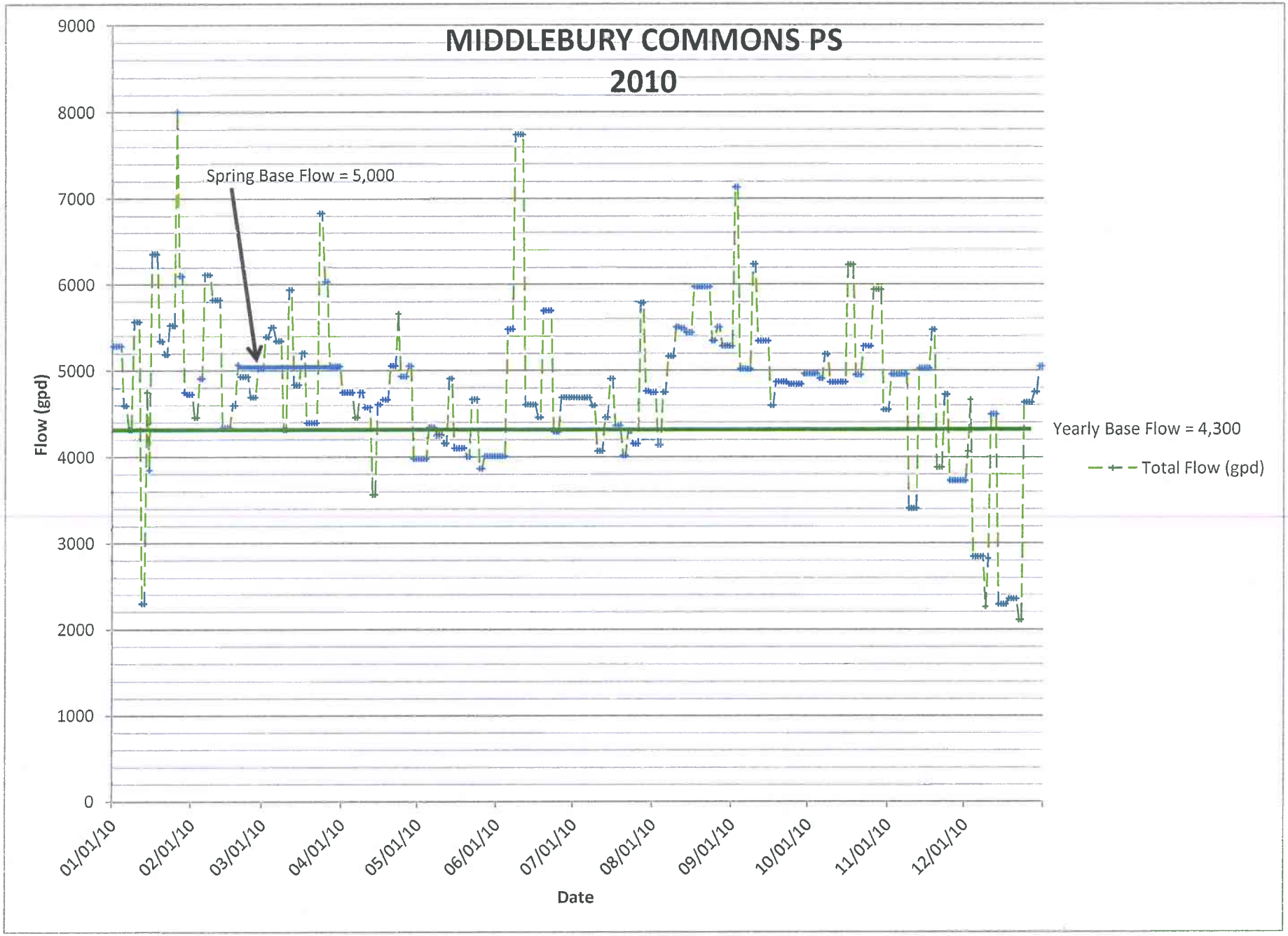

HALPIN PS
2011
Spring Base Flow = 11,000
Yearly Base Flow = 6,0000
Total Flow (gpd)
Flow (gpd)
Date
50000
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
01/01/11
02/01/11
03/01/11
04/01/11
05/01/11
06/01/11
07/01/11
08/01/11
09/01/11
10/01/11
11/01/11
12/01/11

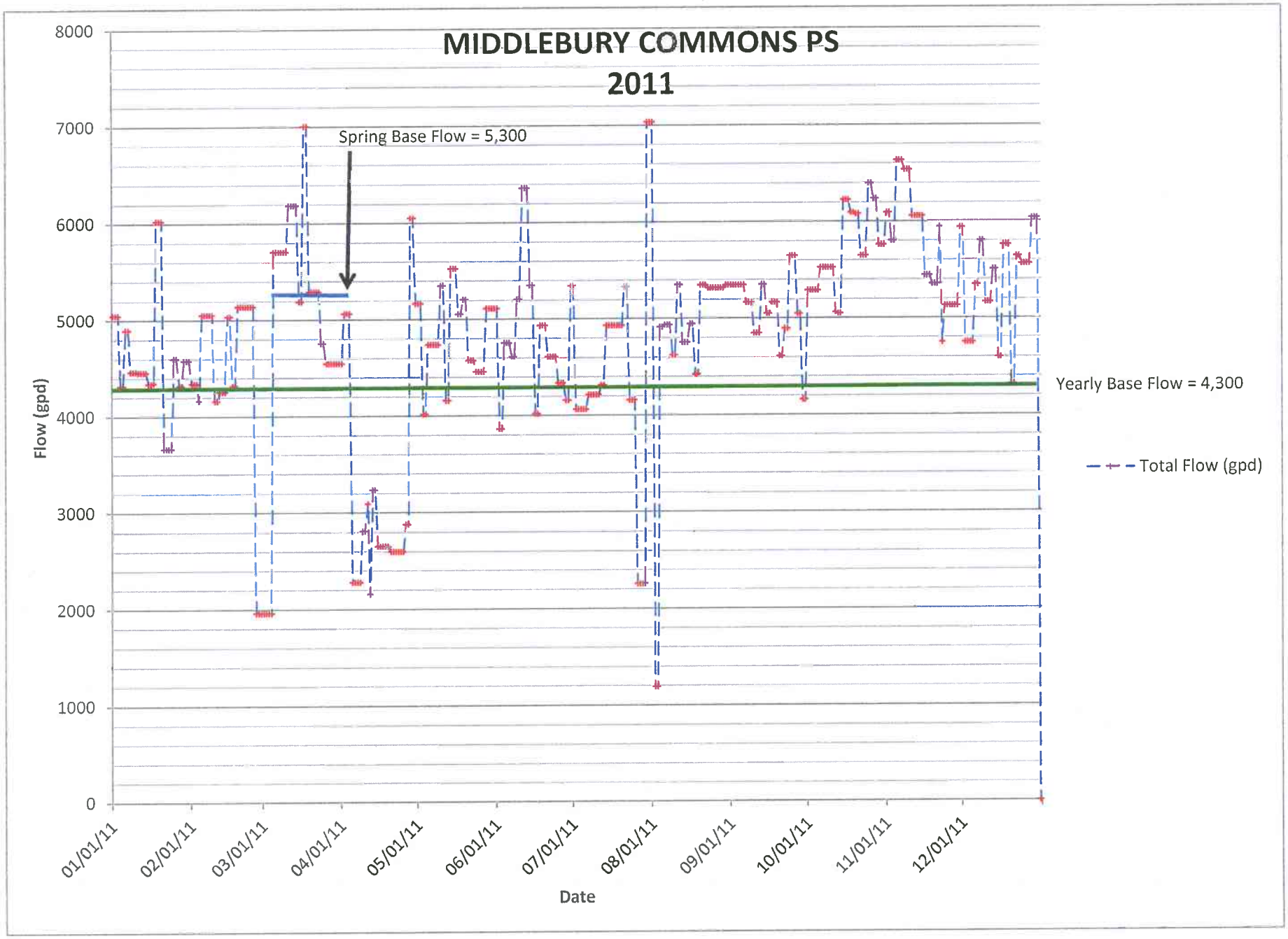

PAINTER PS
2009
Flow (gpd)
20000
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
01/01/09
02/01/09
03/01/09
04/01/09
05/01/09
06/01/09
07/01/09
08/01/09
09/01/09
10/01/09
11/01/09
12/01/09
Date
Spring Base Flow = 4,400
Yearly Base Flow = 1,600
Total Flow (gpd)

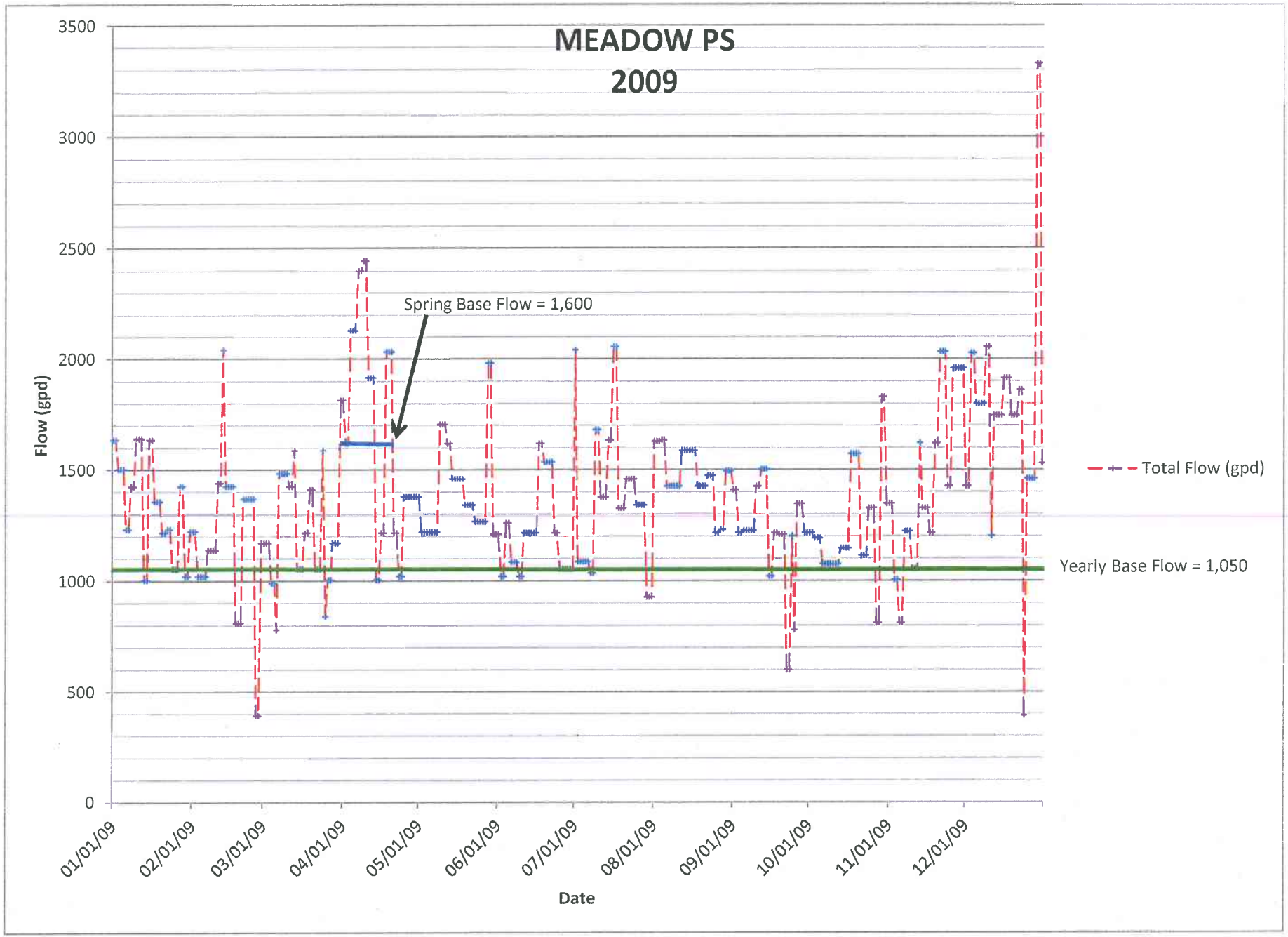

PAINTER PS
2010
Flow (gpd)
20000
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
Spring Base Flow = 3,600
Yearly Base Flow = 1,600
Total Flow (gpd)
01/01/10
02/01/10
03/01/10
04/01/10
05/01/10
06/01/10
07/01/10
08/01/10
09/01/10
10/01/10
11/01/10
12/01/10
Date

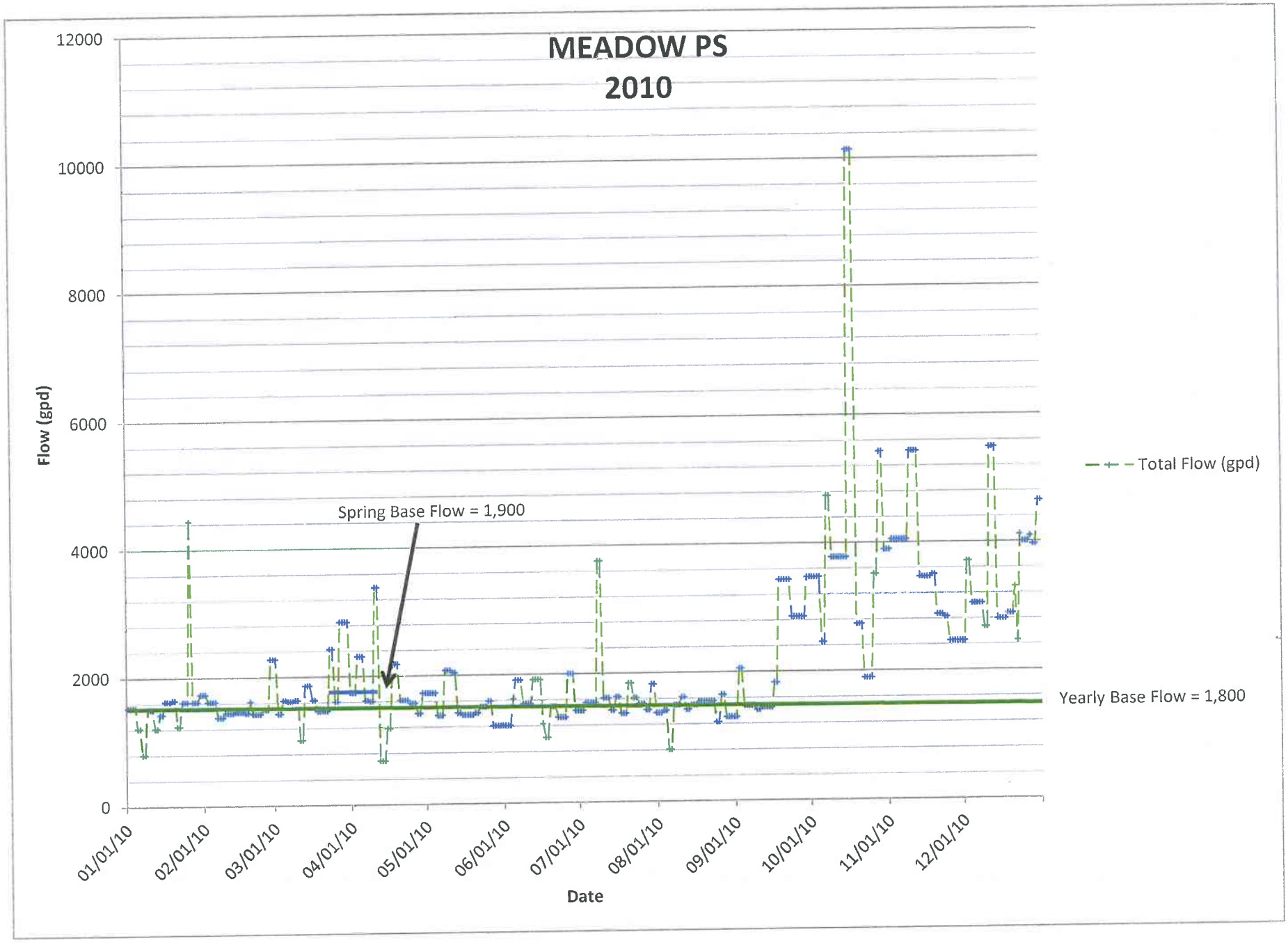

PAINTER PS
2011
Spring Base Flow = 5,100
Yearly Base Flow = 2,800
Total Flow (gpd)
Flow (gpd)
Date
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
01/01/11
02/01/11
03/01/11
04/01/11
05/01/11
06/01/11
07/01/11
08/01/11
09/01/11
10/01/11
11/01/11
12/01/11

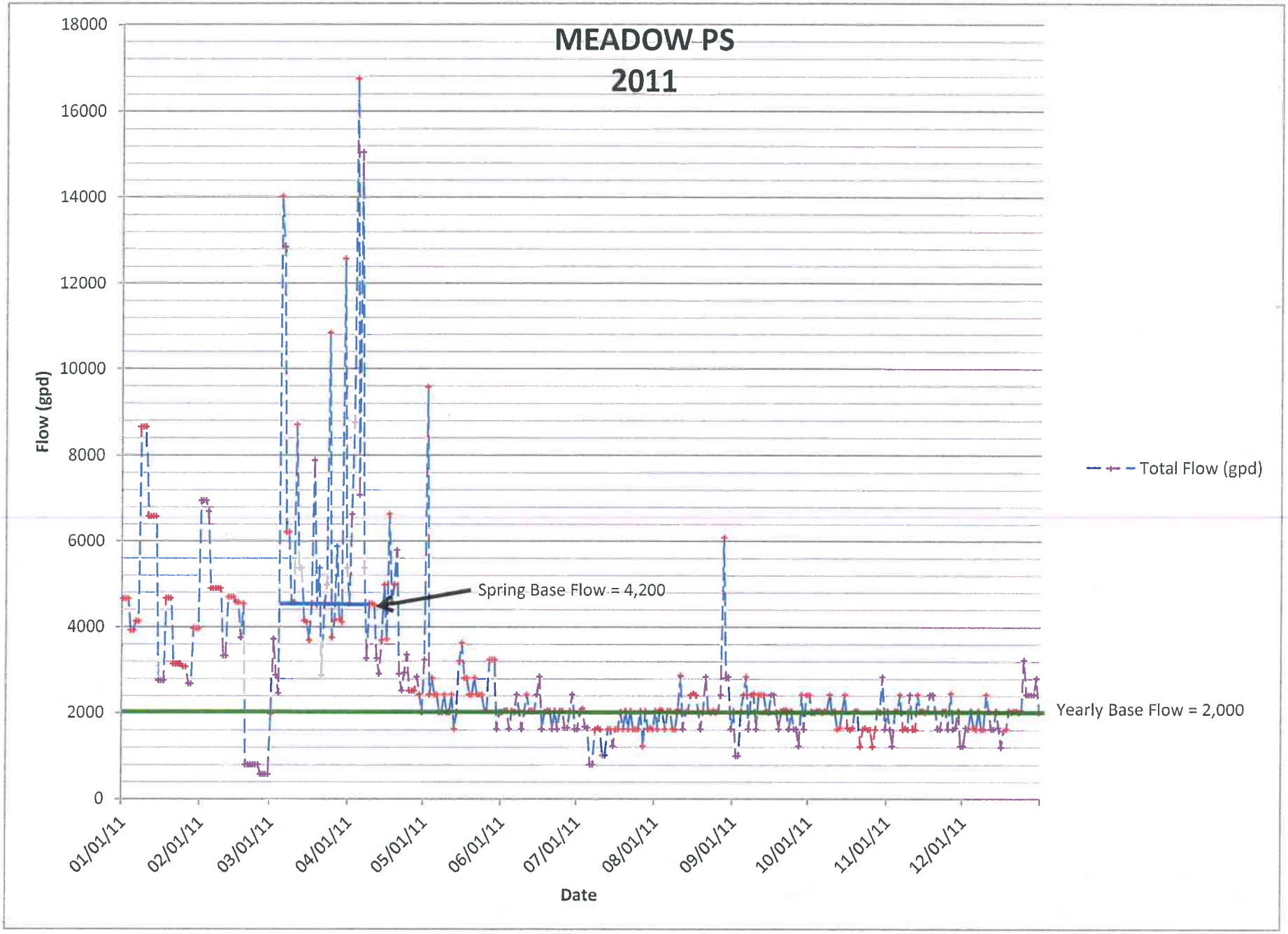

MIDDLEBURY COMMONS PS
2009
Flow (gpd)
14000
12000
10000
8000
6000
4000
2000
0
Spring Base Flow = 5,000
Yearly Base Flow = 4,400
Total Flow (gpd)
01/01/09
02/01/09
03/01/09
04/01/09
05/01/09
06/01/09
07/01/09
08/01/09
09/01/09
10/01/09
11/01/09
12/01/09
Date

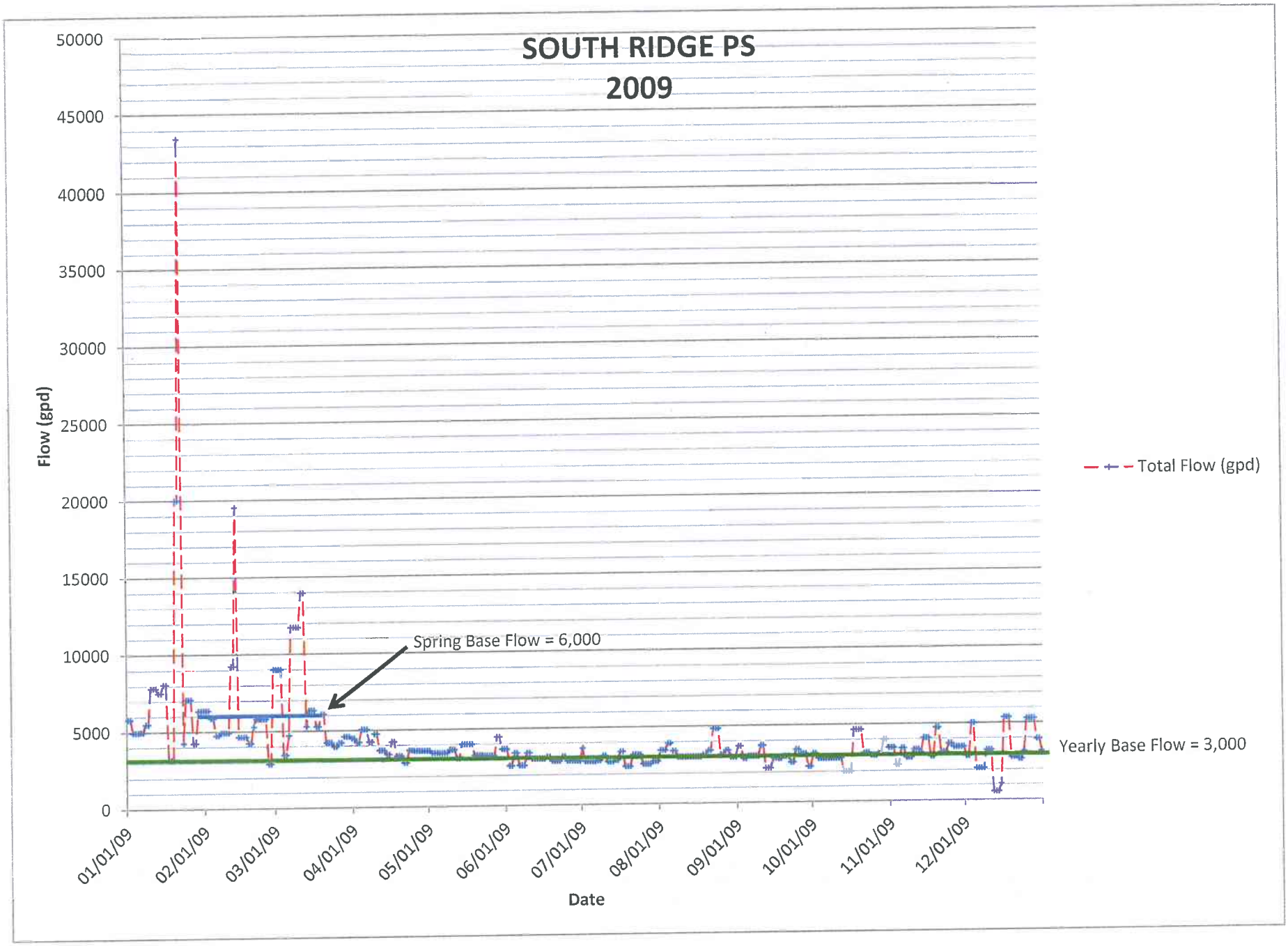

MIDDLEBURY COMMONS PS
2010
Spring Base Flow = 5,000
Yearly Base Flow = 4,300
Total Flow (gpd)
Flow (gpd)
Date
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
01/01/10
02/01/10
03/01/10
04/01/10
05/01/10
06/01/10
07/01/10
08/01/10
09/01/10
10/01/10
11/01/10
12/01/10

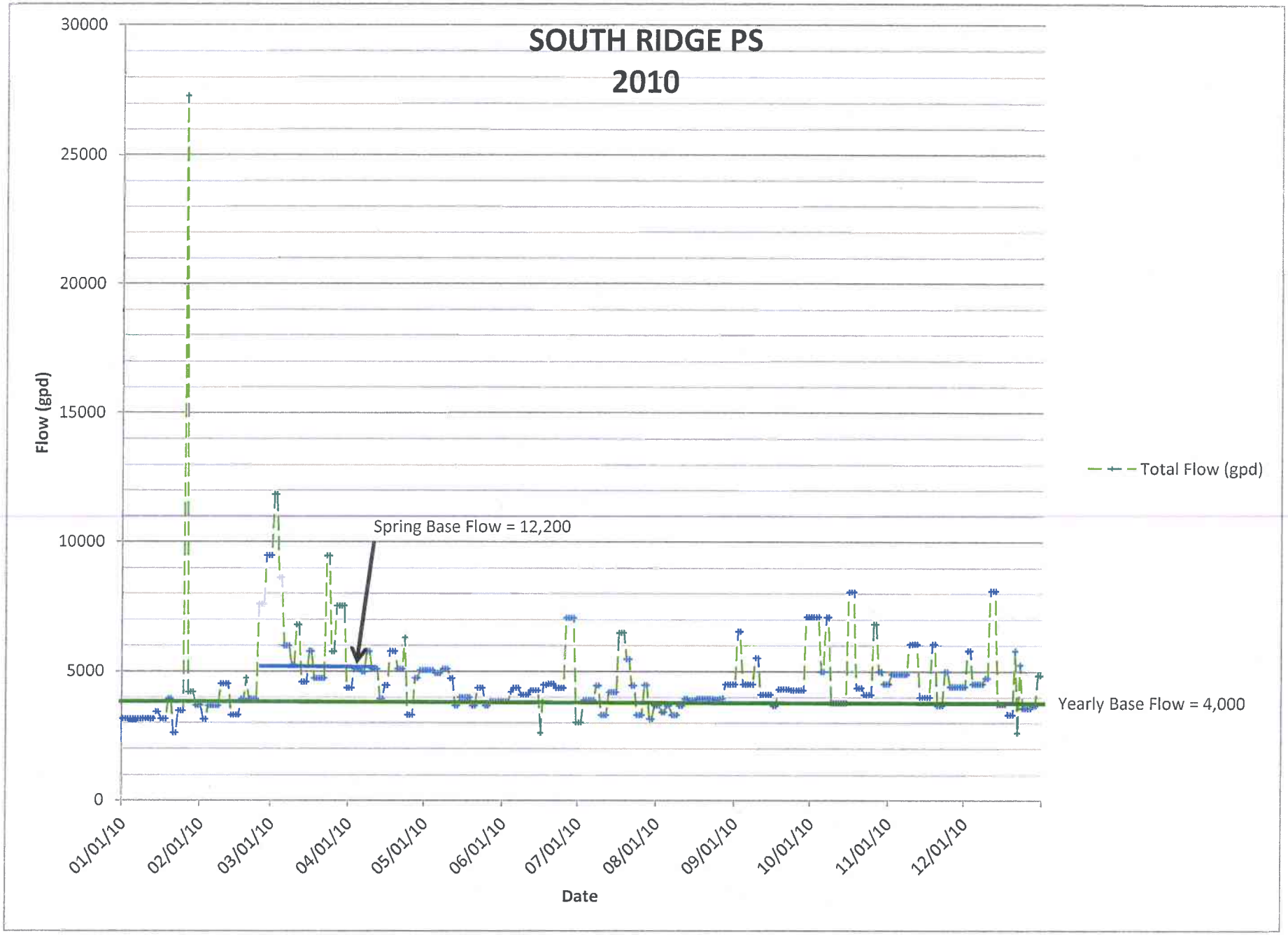

MIDDLEBURY COMMONS PS
2011
Spring Base Flow = 5,300
Yearly Base Flow = 4,300
Total Flow (gpd)
Flow (gpd)
Date
8000
7000
6000
5000
4000
3000
2000
1000
0
01/01/11
02/01/11
03/01/11
04/01/11
05/01/11
06/01/11
07/01/11
08/01/11
09/01/11
10/01/11
11/01/11
12/01/11

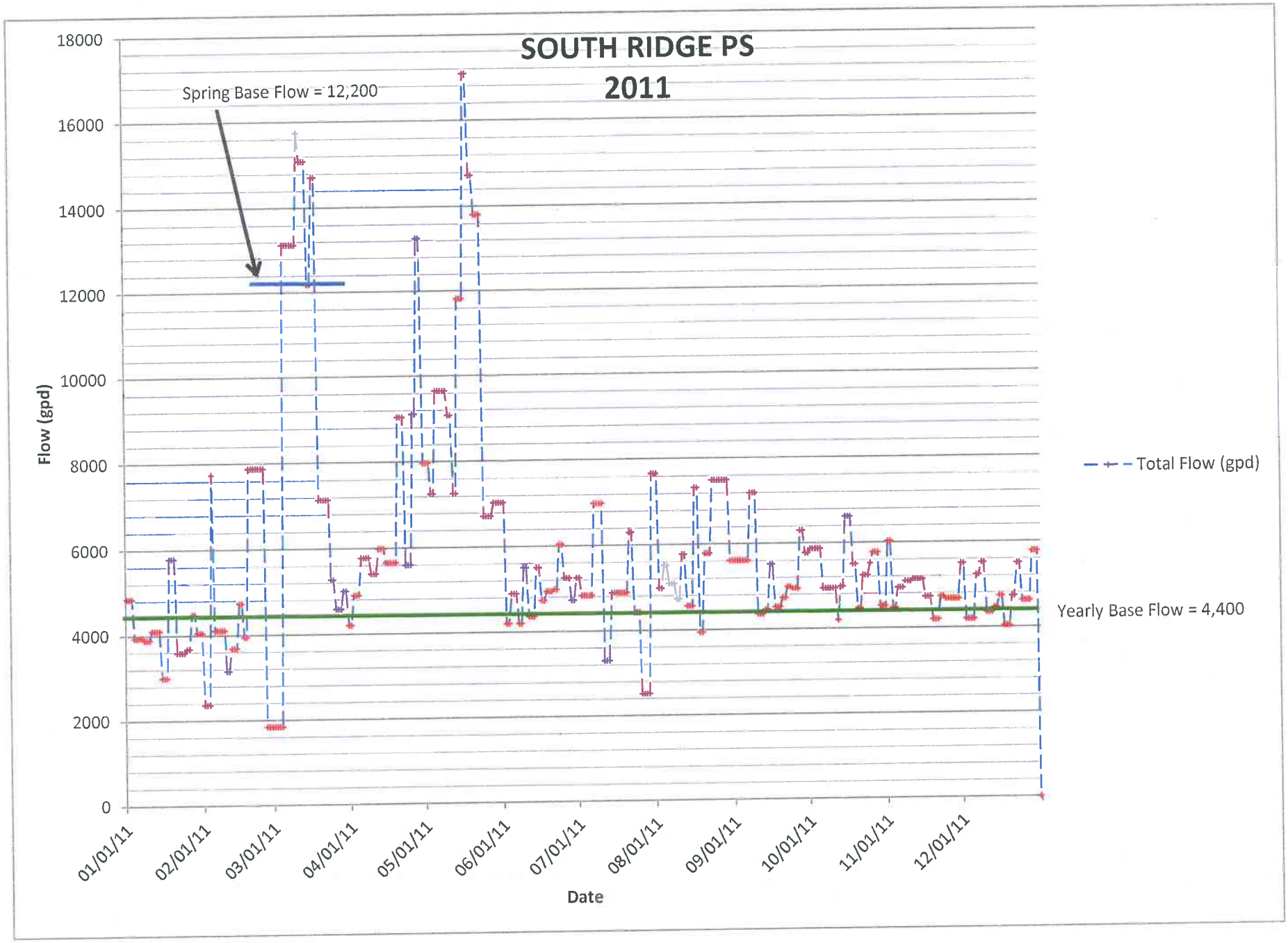

MEADOW PS
2009
Spring Base Flow = 1,600
Yearly Base Flow = 1,050
Total Flow (gpd)
Flow (gpd)
Date
3500
3000
2500
2000
1500
1000
500
0
01/01/09
02/01/09
03/01/09
04/01/09
05/01/09
06/01/09
07/01/09
08/01/09
09/01/09
10/01/09
11/01/09
12/01/09


MEADOW PS
2010
12000
10000
8000
6000
4000
2000
0
Flow (gpd)
Spring Base Flow = 1,900
Yearly Base Flow = 1,800
Total Flow (gpd)
01/01/10
02/01/10
03/01/10
04/01/10
05/01/10
06/01/10
07/01/10
08/01/10
09/01/10
10/01/10
11/01/10
12/01/10
Date


MEADOW PS
2011
Flow (gpd)
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
01/01/11
02/01/11
03/01/11
04/01/11
05/01/11
06/01/11
07/01/11
08/01/11
09/01/11
10/01/11
11/01/11
12/01/11
Date
Spring Base Flow = 4,200
Yearly Base Flow = 2,000
Total Flow (gpd)


SOUTH RIDGE PS
2009
50000
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
Flow (gpd)
Spring Base Flow = 6,000
Yearly Base Flow = 3,000
Total Flow (gpd)
01/01/09
02/01/09
03/01/09
04/01/09
05/01/09
06/01/09
07/01/09
08/01/09
09/01/09
10/01/09
11/01/09
12/01/09
Date


SOUTH RIDGE PS
2010
30000
25000
20000
15000
10000
5000
0
Flow (gpd)
Spring Base Flow = 12,200
Total Flow (gpd)
Yearly Base Flow = 4,000
01/01/10
02/01/10
03/01/10
04/01/10
05/01/10
06/01/10
07/01/10
08/01/10
09/01/10
10/01/10
11/01/10
12/01/10
Date


SOUTH RIDGE PS
2011
Spring Base Flow = 12,200
Yearly Base Flow = 4,400
Total Flow (gpd)
Flow (gpd)
Date
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
01/01/11
02/01/11
03/01/11
04/01/11
05/01/11
06/01/11
07/01/11
08/01/11
09/01/11
10/01/11
11/01/11
12/01/11

APPENDIX C

1ST NIGHT FLOW GAUGING DATA
APRIL11, 2013

TOWN OF MIDDLEBURY
SEWER SYSTEM EVALUATION STUDY
HIGH SCHOOL PUMP STATION
INFILTRATION ANALYSIS (NIGHT OF April 11, 2013)

SUBAREA / MANHOLE	STREET	PIPELINE SEGMENT	DOWNSTREAM MEASURED FLOW (GPD)	UPSTREAM MEASURED FLOW (GPD)	SEGMENT FLOW (GPD)	PIPE DIAMETER (INCHES)	PIPE LENGTH (FEET)	PIPE AREA (IN-MILE)	INFILTRATION FLOW (Gal/day / in.-mile)	NOTES
0655	Buttolph Drive	0655 / 0659	13,460	11,705	1,755	8	230	0.3	5,036	TV
		0655 / Monroe Street	1,064	0	1,064	8	795	1.2		
						6	165	0.2		
						4	280	0.2		
						Total	1,240	1.6	663	Good
0659	Buttolph Drive	0659 / Swange St.-Woodland Park	11,590	0	11,590	8	5,020	7.6		
						6	395	0.4		
						Total	5,415	8.1	1,439	Measure 0659 & 0701
		0659 / 0644	115	0	115	8	3,180	4.8		
						6	125	0.1		
						Total	3,305	5.0	23	Good
0673	Charles Avenue	0673 / 0674	260	0	260	8	785	1.2	219	Good
		0673 / 0677	25,160	22,070	3,090	12	210	0.5		
						6	570	0.6		
						4	180	0.1		
						Total	960	1.3	2,450	TV
0677	US Rte 7 / Charles Avenue	0677 / 0693 (End of US Rte. 7)	22,070	20,510	1,560	10	60	0.1		
						8	1,020	1.5		
						4	45	0.0		
						Total	1,125	1.7	921	Good
		0677 / 0647 (End of US Rte 7)	0	0	0	10	485	0.9		
						8	310	0.5		
						Total	795	1.4	0	Good
0682	HS PS	0682 / 0658	1,064	0	1,064	8	580	0.9		
						6	360	0.4		
						4	50	0.0		
						Total	990	1.3	803	Good
		0682 / 0681	4,690	0	4,690	8	385	0.6	8,040	TV
		0682 / 0673	32,000	25,420	6,580	12	425	1.0		
						6	360	0.4		
						4	50	0.0		
						Total	835	1.4	4,657	TV
0693	Monroe Street CC	0693 / 0655	20,510	14,524	5,986	8	1,305	2.0		
						6	365	0.4		
						Total	1,670	2.4	2,502	Measure 0693, 0691 & 0655
		0693 / Overbrook Dr	0	0	0	8	535	0.8		
						6	310	0.4		
						Total	845	1.2	0	Good

TOWN OF MIDDLEBURY
SEWER SYSTEM EVALUATION STUDY
PUMP STATION #6
INFILTRATION ANALYSIS (NIGHT OF April 11, 2013)

SUBAREA / MANHOLE	STREET	PIPELINE SEGMENT	DOWNSTREAM MEASURED FLOW (GPD)	UPSTREAM MEASURED FLOW (GPD)	SEGMENT FLOW (GPD)	PIPE DIAMETER (INCHES)	PIPE LENGTH (FEET)	PIPE AREA (IN-MILE)	INFILTRATION FLOW (Gal/day / in.-mile)	NOTES
06-001	Seminary Street	06-001 / End Forbes Circle	13,460	0	13,460	8	2,378	3.6		
						6	652	0.7		
						4	100	0.1		
						Total	3,130	4.4	3,045	Measure 06-003 & 06-007
06-014	Seminary Street	06-014 / 06-021	37,550	35,917	1,633	8	85	0.1	12,680	TV
		06-014 / 06-024	4,690	0	4,690	8	1,600	2.4	1,935	TV
06-021	Seminary Street	06-021 / 06-028	35,860	23,078	12,782	8	1,326	2.0	6,362	Measure 06-021, 06-026 & 06-028
		06-021 / End of Seminary St. Ext.	57	0	57	8	440	0.7	86	Good
06-028	Washington Street	06-028 / End of Peterson Terr.	3,689	0	3,689	8	1,538	2.3	1,583	Good
		06-028 / 06-040	19,389	18,787	602	8	384	0.6	1,035	Good
06-039	Washington Street	06-039 / End of Colonial Dr.	3,689	0	3,689	8	830	1.3	2,933	TV
		06-039 / 06-044	9,243	0	9,243	8	1,790	2.7	3,408	Measure 06-039 & 06-046
06-040	Washington Street	06-040 / 06-039	18,730	12,932	5,798	8	117	0.2	32,707	TV
		06-040 / 06-041	57	0	57	8	625	0.9	60	Good
		06-040 / ????	0	0	0	8	0	0.0	0	Good

TOWN OF MIDDLEBURY
SEWER SYSTEM EVALUATION STUDY
PUMP STATION #9
INFILTRATION ANALYSIS (NIGHT OF April 11, 2013)

SUBAREA / MANHOLE	STREET	PIPELINE SEGMENT	DOWNSTREAM MEASURED FLOW (GPD)	UPSTREAM MEASURED FLOW (GPD)	SEGMENT FLOW (GPD)	PIPE DIAMETER (INCHES)	PIPE LENGTH (FEET)	PIPE AREA (IN-MILE)	INFILTRATION FLOW (Gal/day / in.-mile)	NOTES
09-002W	Pulp Mill Bridge Road	09-002W / Otter Creek Lane	<57	0	<57	8	790	1.2		
						6	35	0.0		
						Total	825	1.2	<46	
		09-002W / 09-005W	57	57	0	8	150	0.2	0	
09-005W	Pulp Mill Bridge Road	09-005W / 09-012W	0	0	0	8	190	0.3		
						4	200	0.2		
						Total	390	0.4	0	
		09-005W / 09-013W (End)	0	0	0	6	820	0.9	0	
		09-005W / 09-006W (End)	57	0	57	8	930	1.4		
						6	120	0.1		
						4	120	0.1		
						Total	1,170	1.6	35	
09-003	Weybridge Street	09-003 / 09-002W	3,032	57	2,975	8	770	1.2	2,550	TV
09-011	Weybridge Street	09-011 / 09-012	0	0	0	4	410	0.3	0	
		09-011 / 09-017	1,458	0	1,458	8	635	1.0	1,515	TV
		09-011 / 09-013	22,070	21,753	317	10	270	0.5	620	
09-013	Weybridge Street	09-013 / 09-023	5,473	0	5,473	8	3,980	6.0		
						6	1,000	1.1		
						4	2,475	1.9		
						Total	7,455	9.0	605	
		09-013 / 09-014	16,280	0	16,280	10	375	0.7		
						8	415	0.6		
						Total	790	1.3	12,158	TV

TOWN OF MIDDLEBURY
SEWER SYSTEM EVALUATION STUDY
PUMP STATION #12
INFILTRATION ANALYSIS (NIGHT OF April 11, 2013)

SUBAREA / MANHOLE	STREET	PIPELINE SEGMENT	DOWNSTREAM MEASURED FLOW (GPD)	UPSTREAM MEASURED FLOW (GPD)	SEGMENT FLOW (GPD)	PIPE DIAMETER (INCHES)	PIPE LENGTH (FEET)	PIPE AREA (IN-MILE)	INFILTRATION FLOW (Gal/day / in.-mile)	NOTES
12-001	Middle Road S	12-001 / 12-004	46,610	32,760	13,850	18	2,240	7.64	1,814	No Manholes
12-004	US Rte 7 / Middle Road S	12-004 / 12-005	3,320	2,270	1,050	8	90	0.14	7,700	TV
		12-004 / Unmarked	29,440	5,402	24,038	18	2,000	6.82	3,526	No Manholes
12-005	US Rte 7 / Foote St	12-005 / 12-006	2,270	0	2,270	8	170	0.26	8,813	TV
		12-005 / 12-007	0	0	0	8	78	0.12	0	Good
12-008	Cady Road	12-008 / 12-010	57	0	57	8	1,945	2.95		
						6	1,410	1.60		
						Total	3,355	4.55	13	Good
		12-008 / 07-67	1,064	0	1,064	8	1,735	2.63	405	Good
Unmarked	US Rte 7 / Cady Road	Unmarked / 12-008	4,960	1,121	3,839	8	500	0.76	5,067	TV
		Unmarked / 07-66	442	0	442	12	1,540	3.50		
						8	980	1.48		
						Total	2,520	4.98	89	Good

APPENDIX D

2ND NIGHT FLOW GAUGING DATA
MAY 1, 2013

TOWN OF MIDDLEBURY
SEWER SYSTEM EVALUATION STUDY
HIGH SCHOOL PUMP STATION
INFILTRATION ANALYSIS (NIGHT OF May 1, 2013)

SUBAREA / MANHOLE	STREET	PIPELINE SEGMENT	DOWNSTREAM MEASURED FLOW (GPD)	UPSTREAM MEASURED FLOW (GPD)	SEGMENT FLOW (GPD)	PIPE DIAMETER (INCHES)	PIPE LENGTH (FEET)	PIPE AREA (IN-MILE)	INFILTRATION FLOW (Gal/day / in.-mile)	NOTES
0655	Buttolph Drive	0655 / 0659	18,110	16,492	1,618	8	230	0.3	4,643	TV
		0655 / Monroe Street	<57	0	<57	8	795	1.2		
						6	165	0.2		
						4	280	0.2		
						Total	1,240	1.6	<57	Good
0659	Buttolph Drive	0659 / 0701	13,460	6,208	7,252	8	330	0.5	14,504	TV
		0659 / 0644	3,032	0	3,032	8	3,180	4.8		
						6	125	0.1		
						Total	3,305	5.0	611	Good
0701	Swanage Court	0701 / 0101	735	0	735	8	1,390	2.1	349	Good
		0701 / 0092	5,473	0	5,473	8	3,015	4.6		
						6	580	0.7		
						Total	3,595	5.2	1,047	Good
0690	Monroe Street CC	0690 / 0655	18,110	18,110	0	8	235	0.4	0	
		0690 / 0654	0	0	0	8	805	1.2	0	
0693	Monroe Street CC	0693 / 0655	28,640	18,110	10,530	8	225	0.3		
						6	365	0.4		
						Total	590	0.8	13,934	TV
		0693 / Overbrook Dr	0	0	0	8	535	0.8		
						6	310	0.4		
						Total	845	1.2	0	

TOWN OF MIDDLEBURY
SEWER SYSTEM EVALUATION STUDY
PUMP STATION #6
INFILTRATION ANALYSIS (NIGHT OF May 1, 2013)

SUBAREA / MANHOLE	STREET	PIPELINE SEGMENT	DOWNSTREAM MEASURED FLOW (GPD)	UPSTREAM MEASURED FLOW (GPD)	SEGMENT FLOW (GPD)	PIPE DIAMETER (INCHES)	PIPE LENGTH (FEET)	PIPE AREA (IN-MILE)	INFILTRATION FLOW (Gal/day / in.-mile)	NOTES
06-003	Seminary Street Ext.	06-003 / 06-005	1,064	464	600	8	730	1.1	542	Good
06-005	Valley View Drive	06-005 / Seminary St.	0	0	0	6	N/A	N/A	0	
		06-005 / East Road	0	0	0	8	N/A	N/A	0	
		06-005 / 06-006	464	0	464	8	555	0.8	552	Good
06-007	Evergreen Lane	06-007 / 06-011	0	0	0	8	545	0.8		
						6	205	0.2		
						4	75	0.1		
						Total	825	1.1	0	
		06-007 / 06-013	0	0	0	8	305	0.5		
						6	190	0.2		
						Total	495	0.7	0	
06-025	Cross Country	06-025 / 06-028	9,243	6,539	2,704	8	1,000	1.5	1,785	TV
06-028	Cross Country	06-028 / 06-029	1,064	0	1,064	8	1,538	2.3	457	Good
		06-028 / 06-039	5,475	5,475	0	8	505	0.8	0	
06-039	Washington Street	06-039 / 06-048	<57	0	<57	8	830	1.3	<57	Good
		06-039 / 06-046	5,475	4,690	785	8	745	1.1	695	Good
06-046	Washington Street	06-046 / 06-052	4,690	0	4,690	8	415	0.6	7,459	TV
		06-046 / 06-047	<57	0	<57	8	270	0.4	<57	Good

TOWN OF MIDDLEBURY
SEWER SYSTEM EVALUATION STUDY
PUMP STATION #9
INFILTRATION ANALYSIS (NIGHT OF June 6, 2013)

SUBAREA / MANHOLE	STREET	PIPELINE SEGMENT	DOWNSTREAM MEASURED FLOW (GPD)	UPSTREAM MEASURED FLOW (GPD)	SEGMENT FLOW (GPD)	PIPE DIAMETER (INCHES)	PIPE LENGTH (FEET)	PIPE AREA (IN-MILE)	INFILTRATION FLOW (Gal/day / in.-mile)	NOTES
09-001W	Pulp Mill Bridge Road	09-001W / 09-002W	464	0	464	8	2,060	3.1		
						6	975	1.1		
						4	320	0.2		
						Total	3,355	4.5	104	
		09-001W / Pulp Mill Bridge	0	0	0	8	N/A	N/A	0	Stub

APPENDIX E

3RD NIGHT FLOW GAUGING DATA
JUNE 6, 2013

TOWN OF MIDDLEBURY
SEWER SYSTEM EVALUATION STUDY
PUMP STATION #6
INFILTRATION ANALYSIS (NIGHT OF June 6, 2013)

SUBAREA / MANHOLE	STREET	PIPELINE SEGMENT	DOWNSTREAM MEASURED FLOW (GPD)	UPSTREAM MEASURED FLOW (GPD)	SEGMENT FLOW (GPD)	PIPE DIAMETER (INCHES)	PIPE LENGTH (FEET)	PIPE AREA (IN-MILE)	INFILTRATION FLOW (Gal/day / in.-mile)	NOTES
06-001	Seminary Street Ext.	06-001 / 06-005	57	57	0	8	760	1.2	0	
06-005	Valley View Drive	06-005 / Seminary St.	0	0	0	6	N/A	N/A	0	
		06-005 / East Road	0	0	0	8	N/A	N/A	0	
		06-005 / 06-007	57	0	57	8	555	0.8	68	
06-007	Evergreen Lane	06-007 / 06-013	0	0	0	8	300	0.5		
						6	200	0.2		
						4	75	0.1		
						Total	575	0.7	0	
		06-007 / 06-011	0	0	0	8	590	0.9	0	
06-021	Cross Country	06-021 / 06-026	13,280	13,280	0	8	650	1.0	0	
	Seminary Street Ext.	06-021 / 06-023	<57	0	<57	8	440	0.7	<85	
06-026	Cross Country	06-026 / 06-028	13,280	12,960	320	8	665	1.0	318	
		06-026 / Washington	0	0	0	8	N/A	N/A	0	
06-028	Cross Country	06-028 / 06-029	1,440	114	1,326	8	400	0.6	2,188	
		06-028 / End of Washington St	11,520	0	11,520	8	2,765	4.2	2,750	
06-029	Peterson Terrace	06-029 / 06-036	57	0	57	8	1,050	1.6		
						6	300	0.3		
						Total	1,350	1.9	30	
		06-029 / 05-029	57	0	57	8	360	0.5	105	

TOWN OF MIDDLEBURY
SEWER SYSTEM EVALUATION STUDY
HIGH SCHOOL PUMP STATION
INFILTRATION ANALYSIS (NIGHT OF JUNE 6, 2013)

SUBAREA / MANHOLE	STREET	PIPELINE SEGMENT	DOWNSTREAM MEASURED FLOW (GPD)	UPSTREAM MEASURED FLOW (GPD)	SEGMENT FLOW (GPD)	PIPE DIAMETER (INCHES)	PIPE LENGTH (FEET)	PIPE AREA (IN-MILE)	INFILTRATION FLOW (Gal/day / in.-mile)	NOTES
0701	Cross Country / Woodland Park	0701 / 0092	13,460	3,032	10,428	8	360	0.5	19,118	
		0701 / 0095	3,032	57	2,975	8	890	1.3	2,206	
0092	Meadow Way	0092 / Heritage Circle	3,032	0	3,032	8	1,640	2.5	1,220	
		0092 / 0094	<57	0	<57	6	400	0.5	<114	
0095	Woodland Park	0095 / 0101	<57	0	<57	8	645	1.0	<57	

TOWN OF MIDDLEBURY
SEWER SYSTEM EVALUATION STUDY
PUMP STATION #12
INFILTRATION ANALYSIS (NIGHT OF June 6, 2013)

SUBAREA / MANHOLE	STREET	PIPELINE SEGMENT	DOWNSTREAM MEASURED FLOW (GPD)	UPSTREAM MEASURED FLOW (GPD)	SEGMENT FLOW (GPD)	PIPE DIAMETER (INCHES)	PIPE LENGTH (FEET)	PIPE AREA (IN-MILE)	INFILTRATION FLOW (Gal/day / in.-mile)	NOTES
12-001	Middle Road S	12-001 / Unmarked # 1	37,960	21,710	16,250	20	650	2.46	6,600	
Unmarked # 1	Middle Road S	Unmarked # 1 / 12-004	21,710	21,710	0	18	1,640	5.59	0	
12-004	US Rte 7 / Middle Road S	12-004 / 12-005	<57	0	<57	8	90	0.14	<407	
		12-004 / Unmarked # 2	21,710	19,090	2,620	18	1,200	4.09	640	
Unmarked # 2	US Rte 7	Unmarked # 2 / Unmarked # 3	19,090	19,090	0	18	800	2.73	0	
Unmarked # 3	US Rte 7	Unmarked # 3 / End of Cady Road	4,690	0	4,690	8	2,445	3.70		
						6	1,410	1.60		
						Total	3,855	5.31	884	
		Unmarked # 3 / 07-66	14,400	0	14,400	12	1,540	3.50		
						8	980	1.48		
						Total	2,520	4.98	2,289	

APPENDIX F

MANHOLE OBSERVATION SHEETS

MANHOLE OBSERVATION SHEET

Location/Street Edge Railroad/Cross Country M.H. OBS. 0395 / _____

PROJECT NO.: 11070	DATE: 12/20/12
PROJECT: Middlebury Exchange Street Manhole Inspections	TIME: 1003
INSPECTOR: Kevin J. Camara, P.E.	

LOCATION IN:

- Bit. Pavement ☐
- Grass/Lawn ☐
- Gravel ☐
- Other ☒
- Woods

TYPE OF MANHOLE:

- Precast ☒
- Block ☐
- Brick ☐
- Inside Drop ☐
- Outside Drop ☐

FRAME & COVER:

Drain Holes? Y (N) How Many? ____
Material: CI ☒ Concrete ☐ Other ☐ _____
Cover Size: 24" Diameter or _____ x _____
Clear Opening 22" Diameter or _____ x _____
Mortared? Y (N) Centered? (Y) N
General Condition:
Biological slime on inside.

INVERT:

Uniform ☐ Non-Uniform ☒
Smooth ☐ Rough ☒
Solids Accumulated? Y (N)
Brick ☒ Concrete ☐ PVC ☐
Describe:
Minor concrete deterioration and spalling. Significant slime growth.

RISERS AND JOINTS:

Flat Top	_____
Conical Top	1
No. of Risers	1
Base	1
Mortared	_____
Other	_____

LADDER RUNGS:

- Aluminum ☒
- Iron ☐
- Plastic ☐
- Appear Safe? Y (N)
- Other:
- Coated with slime

DIMENSIONS:

Depth 8'-9" +/- (Rim to Invert)
Inside Dia. 4'-0"
Inside Dimensions: _____ x _____
Other: _____

SHELF: None ☐ Mortar ☒ Brick ☐ Sloped ☒ Smooth ☐ Rough ☒
Describe: Mortar deteriorated and concrete spalling.

NOTICEABLE DEFICIENCIES:

GRIT? (Y) N Amount: 4" in Invert
CLEANLINESS: Y (N) Describe: Manhole walls covered in bacterial slime growth.
EXTRANEOUS WATER? (Y) N Quantity: 5 gpm Location: 8" inlet pipe connection from west. MH Joint weeping
CRACKS? (Y) N Describe: Hole in MH Wall.
Evidence of Surcharging? (Y) N
Lift Holes Plugged? (Y) N

OTHER COMMENTS AND REMARKS:

Minor roots on walls. Minor deterioration and spalling of concrete walls.

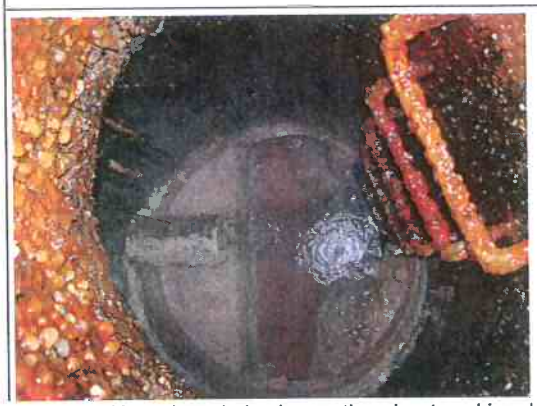
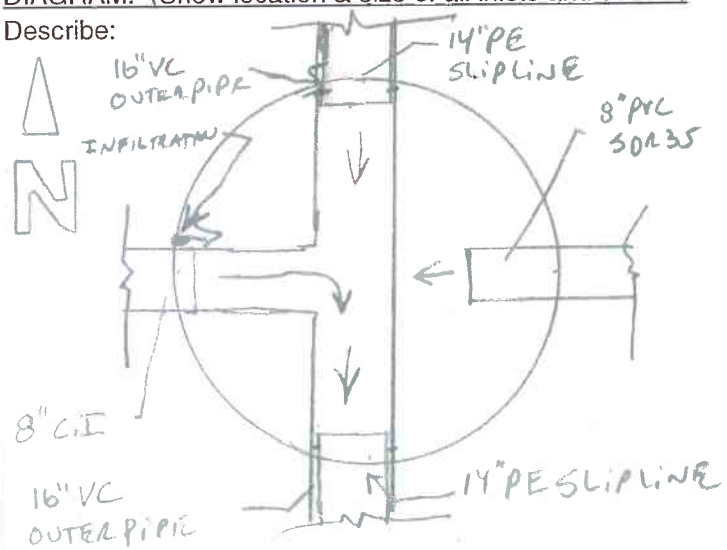


DIAGRAM: (Show location & size of all inlets and outlets)
Describe:



MANHOLE OBSERVATION SHEET

Location/Street Edge Railroad/Cross Country M.H. OBS. 0398 / _____

PROJECT NO.: 11070	DATE: 12/20/12
PROJECT: Middlebury Exchange Street Manhole Inspections	TIME: 1043
INSPECTOR: Kevin J. Camara, P.E.	

LOCATION IN:

- Bit. Pavement ☐
- Grass/Lawn ☐
- Gravel ☐
- Other ☒
- Woods

TYPE OF MANHOLE:

- Precast ☒
- Block ☐
- Brick ☐
- Inside Drop ☐
- Outside Drop ☐

FRAME & COVER:

Drain Holes? Y (N) How Many? ____
Material: CI ☒ Concrete ☐ Other ☐ _____
Cover Size: 24" Diameter or _____ x _____
Clear Opening 22" Diameter or _____ x _____
Mortared? (Y) N Centered? (Y) N
General Condition: Good

INVERT:

Uniform ☐ Non-Uniform ☐
Smooth ☐ Rough ☐
Solids Accumulated? Y N
Brick ☐ Concrete ☐ PVC ☐
Describe:
Good condition.
N/A Straight through hard piped.

RISERS AND JOINTS:

Flat Top ____
Conical Top 1
No. of Risers ____
Base 1
Mortared ____
Other ____

LADDER RUNGS:

Aluminum ☒
Iron ☐
Plastic ☐
Appear Safe? (Y) N
Other:

DIMENSIONS:

Depth 6'-9" +/- (Rim to Invert)
Inside Dia. 4'-0"
Inside Dimensions: _____ x _____
Other:

SHELF: None ☐ Mortar ☐ Brick ☐ Sloped ☐ Smooth ☐ Rough ☐
Describe: No shelf.

NOTICEABLE DEFICIENCIES:

GRIT? Y (N) Amount: _____
CLEANLINESS: (Y) N Describe:
EXTRANEOUS WATER? Y (N) Quantity:
CRACKS? Y (N) Describe:

Evidence of Surcharging? Y (N)
Lift Holes Plugged? Y (N)
Location:

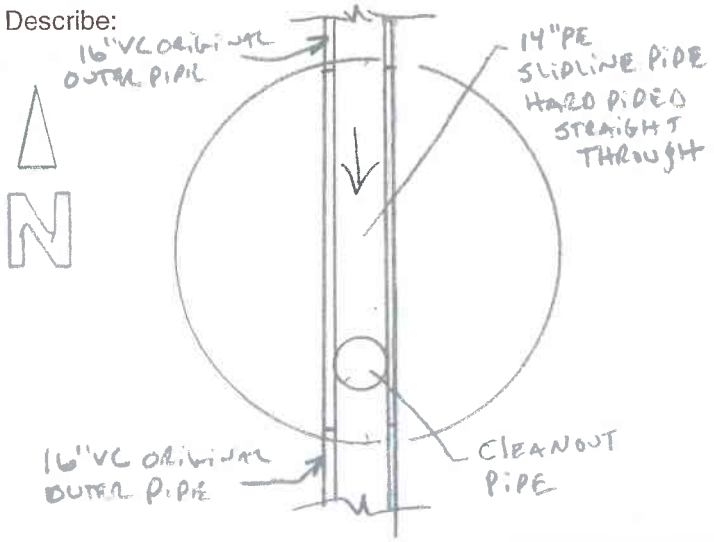
OTHER COMMENTS AND REMARKS:

Small 4" cleanout in manhole bottom. Pipe Encased in concrete. Not good access For maintenance/cleaning.

Minor deterioration/spalling of concrete walls.

DIAGRAM: (Show location & size of all inlets and outlets)

Describe:



MANHOLE OBSERVATION SHEET

Location/Street Edge Railroad/Cross Country M.H. OBS. 0399 / _____

PROJECT NO.: 11070	DATE: 12/20/12
PROJECT: Middlebury Exchange Street Manhole Inspections	TIME: 1016
INSPECTOR: Kevin J. Camara, P.E.	

LOCATION IN:
- Bit. Pavement ☐
- Grass/Lawn ☐
- Gravel ☐
- Other ☒
- Woods

TYPE OF MANHOLE:
- Precast ☒
- Block ☐
- Brick ☐
- Inside Drop ☐
- Outside Drop ☐

FRAME & COVER:
Drain Holes? Y (N) How Many? ____
Material: CI ☒ Concrete ☐ Other ☐ _____
Cover Size: 24" Diameter or _____ x _____
Clear Opening 22" Diameter or _____ x _____
Mortared? Y (N) Centered? Y (N)
General Condition:
Frame pushed over 4". Frame needs to be reset.
Biological slime on inside.

INVERT:
Uniform ☐ Non-Uniform ☒
Smooth ☐ Rough ☒
Solids Accumulated? Y (N)
Brick ☒ Concrete ☐ PVC ☐
Describe:
Minor concrete deterioration and spalling. Significant slime growth.

RISERS AND JOINTS:
Flat Top 1
Conical Top _____
No. of Risers _____
Base 1
Mortared _____
Other _____

LADDER RUNGS:
Aluminum ☒
Iron ☐
Plastic ☐
Appear Safe? Y (N)
Other:
Coated with slime

DIMENSIONS:
Depth 7'-7" +/- (Rim to Invert)
Inside Dia. 4'-0"
Inside Dimensions: _____ x _____
Other:

SHELF: None ☐ Mortar ☒ Brick ☐ Sloped ☒ Smooth ☐ Rough ☒
Describe: Mortar deteriorated and concrete spalling.

NOTICEABLE DEFICIENCIES:
GRIT? Y (N) Amount: _____
CLEANLINESS: (Y) N Describe: Manhole walls covered in bacterial slime growth.
EXTRANEOUS WATER? (Y) N Quantity: 3 gpm Location: 8" inlet pipe connection MH riser Joint weeping
CRACKS? Y (N) Describe:
Evidence of Surcharging? Y (N)
Lift Holes Plugged? (Y) N

OTHER COMMENTS AND REMARKS:
Minor roots on walls. Minor deterioration and spalling of concrete walls.
Inlet slip line pipe push too far into manhole and pinched to < ½ dia. causing flow restriction.

DIAGRAM: (Show location & size of all inlets and outlets)
Describe:

MANHOLE OBSERVATION SHEET

Location/Street Edge Railroad/Cross Country M.H. OBS. 0400 / _____

PROJECT NO.: 11070	DATE: 12/20/12
PROJECT: Middlebury Exchange Street Manhole Inspections	TIME: 1019
INSPECTOR: Kevin J. Camara, P.E.	

LOCATION IN:

- Bit. Pavement ☐
- Grass/Lawn ☐
- Gravel ☐
- Other ☒
- Woods

TYPE OF MANHOLE:

- Precast ☒
- Block ☐
- Brick ☐
- Inside Drop ☐
- Outside Drop ☐

FRAME & COVER:

Drain Holes? Y (N) How Many? ____
Material: CI ☒ Concrete ☐ Other ☐ _____
Cover Size: 24" Diameter or _____ x _____
Clear Opening 22" Diameter or _____ x _____
Mortared? Y (N) Centered? (Y) N
General Condition:
Biological slime on inside.

INVERT:

Uniform ☐ Non-Uniform ☒
Smooth ☐ Rough ☒
Solids Accumulated? Y N
Brick ☒ Concrete ☐ PVC ☐
Describe:
Good condition.

RISERS AND JOINTS:

Flat Top ____
Conical Top 1
No. of Risers ____
Base 1
Mortared ____
Other ____

LADDER RUNGS:

Aluminum ☒
Iron ☐
Plastic ☐
Appear Safe? Y N
Other:
Coated with slime

DIMENSIONS:

Depth 6'-11" +/- (Rim to Invert)
Inside Dia. 4'-0"
Inside Dimensions: _____ x _____
Other:

SHELF: None ☐ Mortar ☒ Brick ☐ Sloped ☒ Smooth ☐ Rough ☒
Describe: Mortar deteriorated and concrete spalling.

NOTICEABLE DEFICIENCIES:

GRIT? Y (N) Amount: _____
CLEANLINESS: Y (N) Describe: Grade stakes and rags stuck in pipe. Manhole walls covered in bacterial slime growth.
EXTRANEOUS WATER? (Y) N Quantity: Weeps Location: MH riser joints.
CRACKS? (Y) N Describe: Around MH riser joints.
Evidence of Surcharging? Y (N)
Lift Holes Plugged? Y (N)

OTHER COMMENTS AND REMARKS:

Minor roots on walls. Minor deterioration and spalling of concrete walls.
Inlet slip line pipe push too far into manhole causing flow restriction.

DIAGRAM: (Show location & size of all inlets and outlets)
Describe:

MANHOLE OBSERVATION SHEET

Location/Street Edge Railroad/Cross Country M.H. OBS. 0403 / _____

PROJECT NO.: 11070	DATE: 12/20/12
PROJECT: Middlebury Exchange Street Manhole Inspections	TIME: 1054
INSPECTOR: Kevin J. Camara, P.E.	

LOCATION IN:

- Bit. Pavement ☐
- Grass/Lawn ☐
- Gravel ☐
- Other ☒
- Woods

TYPE OF MANHOLE:

- Precast ☒
- Block ☐
- Brick ☐
- Inside Drop ☐
- Outside Drop ☐

FRAME & COVER:

Drain Holes? Y (N) How Many? ____
Material: CI ☒ Concrete ☐ Other ☐ _____
Cover Size: 24" Diameter or _____ x _____
Clear Opening 22" Diameter or _____ x _____
Mortared? Y (N) Centered? (Y) N
General Condition: Good

INVERT:

Uniform ☐ Non-Uniform ☐
Smooth ☐ Rough ☐
Solids Accumulated? Y N
Brick ☐ Concrete ☐ PVC ☐
Describe:
Good condition.
N/A Straight through 14" PE hard piped.

RISERS AND JOINTS:

Flat Top ____
Conical Top 1
No. of Risers ____
Base 1
Mortared ____
Other ____

LADDER RUNGS:

Aluminum ☒
Iron ☐
Plastic ☐
Appear Safe? Y N
Other:
Coated with slime

DIMENSIONS:

Depth 6'-9" +/- (Rim to Invert)
Inside Dia. 4'-0"
Inside Dimensions: _____ x _____
Other:

SHELF: None ☐ Mortar ☐ Brick ☐ Sloped ☐ Smooth ☐ Rough ☐
Describe: No shelf.

NOTICEABLE DEFICIENCIES:

GRIT? Y (N) Amount: _____
CLEANLINESS: (Y) N Describe:
EXTRANEOUS WATER? Y (N) Quantity: Location:
CRACKS? Y (N) Describe:

Evidence of Surcharging? Y (N)
Lift Holes Plugged? (Y) N

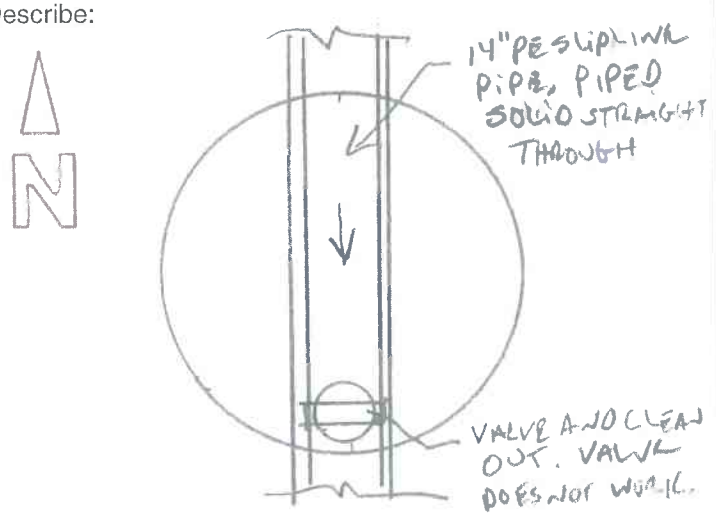
OTHER COMMENTS AND REMARKS:

Small 4" cleanout in manhole bottom. Valve does not work. Not good access for maintenance/cleaning.

Minor deterioration/spalling of concrete walls.

DIAGRAM: (Show location & size of all inlets and outlets)

Describe:



MANHOLE OBSERVATION SHEET

Location/Street Edge Railroad/Cross Country M.H. OBS. 0405 / _____

PROJECT NO.: 11070	DATE: 12/20/12
PROJECT: Middlebury Exchange Street Manhole Inspections	TIME: 1118
INSPECTOR: Kevin J. Camara, P.E.	

LOCATION IN:

- Bit. Pavement ☐
- Grass/Lawn ☐
- Gravel ☐
- Other ☒
- Edge Woods

TYPE OF MANHOLE:

- Precast ☒
- Block ☐
- Brick ☐
- Inside Drop ☐
- Outside Drop ☐

FRAME & COVER:

Drain Holes? Y (N) How Many? ____
Material: CI ☒ Concrete ☐ Other ☐ _____
Cover Size: 24" Diameter or _____ x _____
Clear Opening 22" Diameter or _____ x _____
Mortared? (Y) N Centered? Y (N)
General Condition:
Mortar is cracked. Frame pushed over 6".

INVERT:

Uniform ☐ Non-Uniform ☐
Smooth ☐ Rough ☐
Solids Accumulated? Y N
Brick ☐ Concrete ☐ PVC ☐
Describe:
Good condition.
None Straight 14"PE hard piped

RISERS AND JOINTS:

Flat Top ____
Conical Top 1
No. of Risers 1
Base 1
Mortared ____
Other ____

LADDER RUNGS:

Aluminum ☒
Iron ☐
Plastic ☐
Appear Safe? (Y) N
Other:
Coated with slime

DIMENSIONS:

Depth 9'-6" +/- (Rim to Invert)
Inside Dia. 4'-0"
Inside Dimensions: _____ x _____
Other:

SHELF: None ☐ Mortar ☒ Brick ☐ Sloped ☒ Smooth ☐ Rough ☐
Describe:

NOTICEABLE DEFICIENCIES:

GRIT? Y (N) Amount: _____
CLEANLINESS: (Y) N Describe:
EXTRANEOUS WATER? Y (N) Quantity: Location:
CRACKS? Y (N) Describe:

Evidence of Surcharging? Y (N)
Lift Holes Plugged? (Y) N

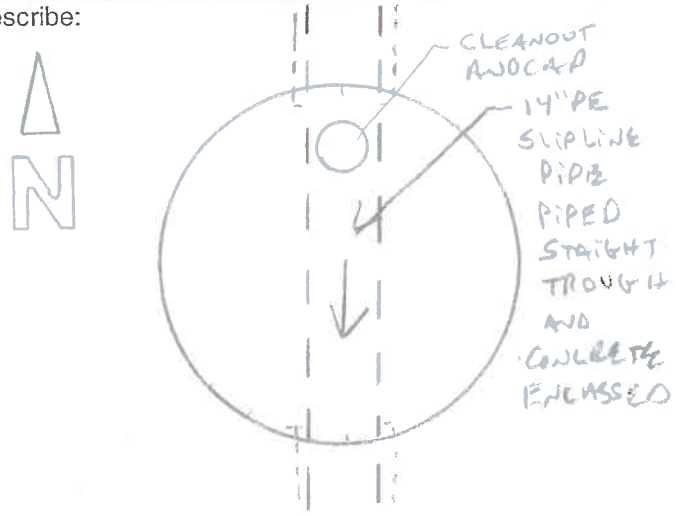
OTHER COMMENTS AND REMARKS:

Cleanout in center of pipe. Not good access for maintenance/cleaning.

Minor deterioration/spalling of concrete walls.

DIAGRAM: (Show location & size of all inlets and outlets)

Describe:



MANHOLE OBSERVATION SHEET

Location/Street Edge Railroad/Cross Country M.H. OBS. 0406 / _____

PROJECT NO.: 11070	DATE: 12/20/12
PROJECT: Middlebury Exchange Street Manhole Inspections	TIME: 1109
INSPECTOR: Kevin J. Camara, P.E.	

LOCATION IN:

- Bit. Pavement ☐
- Grass/Lawn ☐
- Gravel ☐
- Other ☒
- Woods

TYPE OF MANHOLE:

- Precast ☒
- Block ☐
- Brick ☐
- Inside Drop ☐
- Outside Drop ☐

FRAME & COVER:

Drain Holes? Y (N) How Many? ____
Material: CI ☒ Concrete ☐ Other ☐ _____
Cover Size: 24" Diameter or _____ x _____
Clear Opening 22" Diameter or _____ x _____
Mortared? (Y) N Centered? (Y) N
General Condition:
Mortar is cracked.

INVERT:

Uniform ☐ Non-Uniform ☐
Smooth ☐ Rough ☐
Solids Accumulated? Y N
Brick ☐ Concrete ☐ PVC ☐
Describe:
Good condition.
None Straight 14"PE hard piped

RISERS AND JOINTS:

Flat Top _____
Conical Top 1
No. of Risers 1
Base 1
Mortared _____
Other _____

LADDER RUNGS:

Aluminum ☒
Iron ☐
Plastic ☐
Appear Safe? Y N
Other:
Coated with slime

DIMENSIONS:

Depth 8'-11" +/- (Rim to Invert)
Inside Dia. 4'-0"
Inside Dimensions: _____ x _____
Other:

SHELF: None ☐ Mortar ☒ Brick ☐ Sloped ☒ Smooth ☐ Rough ☐
Describe:

NOTICEABLE DEFICIENCIES:

GRIT? Y (N) Amount: _____
CLEANLINESS: (Y) N Describe:
EXTRANEOUS WATER? (Y) N Quantity: Weeps Location: Manhole riser joints
CRACKS? Y (N) Describe:

Evidence of Surcharging? (Y) N
Lift Holes Plugged? (Y) N

OTHER COMMENTS AND REMARKS:

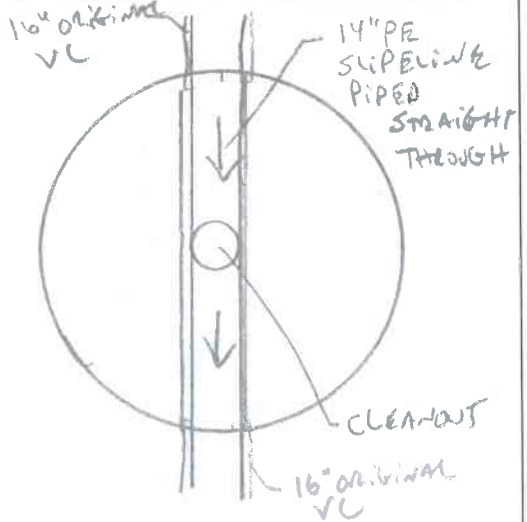
Cleanout in center of pipe. Not good access for maintenance/cleaning. Evidence of surcharging out cleanout.

Minor deterioration/spalling of concrete walls.

DIAGRAM: (Show location & size of all inlets and outlets)

Describe:

N



MANHOLE OBSERVATION SHEET

Location/Street Edge Railroad/Cross Country M.H. OBS. 0407 / _____

PROJECT NO.: 11070	DATE: 12/20/12
PROJECT: Middlebury Exchange Street Manhole Inspections	TIME: 1104
INSPECTOR: Kevin J. Camara, P.E.	

LOCATION IN:

- Bit. Pavement ☐
- Grass/Lawn ☐
- Gravel ☐
- Other ☒
- Woods

TYPE OF MANHOLE:

- Precast ☒
- Block ☐
- Brick ☐
- Inside Drop ☐
- Outside Drop ☐

FRAME & COVER:

Drain Holes? Y (N) How Many? ____
Material: CI ☒ Concrete ☐ Other ☐ _____
Cover Size: 24" Diameter or _____ x _____
Clear Opening 22" Diameter or _____ x _____
Mortared? Y (N) Centered? (Y) N
General Condition:
Frame needs to be mortared.

INVERT:

Uniform ☐ Non-Uniform ☒
Smooth ☒ Rough ☐
Solids Accumulated? Y N
Brick ☐ Concrete ☐ PVC ☐
Describe:
Good condition.
Cut 14" PE pipe

RISERS AND JOINTS:

Flat Top 1
Conical Top _____
No. of Risers 1
Base 1
Mortared _____
Other _____

LADDER RUNGS:

Aluminum ☒
Iron ☐
Plastic ☐
Appear Safe? Y N
Other:
Coated with slime

DIMENSIONS:

Depth 8'-9" +/- (Rim to Invert)
Inside Dia. 4'-0"
Inside Dimensions: _____ x _____
Other:

SHELF: None ☐ Mortar ☒ Brick ☐ Sloped ☐ Smooth ☐ Rough ☐
Describe:

NOTICEABLE DEFICIENCIES:

GRIT? Y (N) Amount: _____
CLEANLINESS: (Y) N Describe:
EXTRANEOUS WATER? (Y) N Quantity: Weeps Location: Manhole riser joints
CRACKS? Y (N) Describe:
Evidence of Surcharging? Y (N)
Lift Holes Plugged? (Y) N

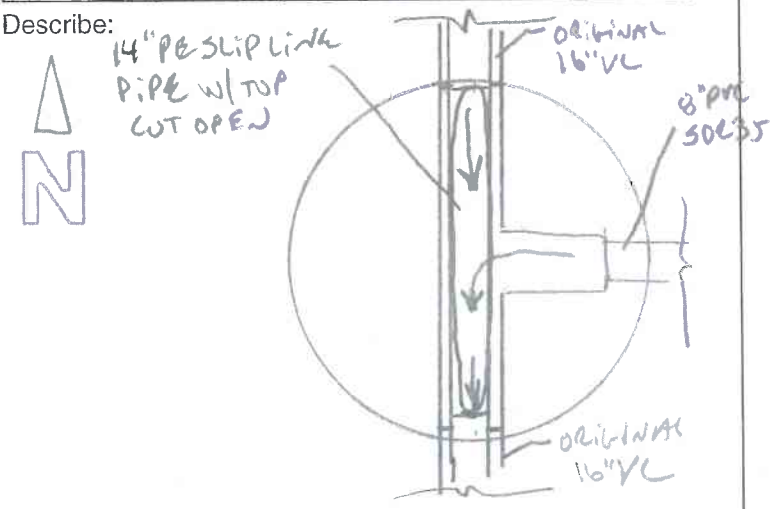
OTHER COMMENTS AND REMARKS:

Cut open top portion of 14" PE. Not good access for maintenance/cleaning.

Minor deterioration/spalling of concrete walls.

DIAGRAM: (Show location & size of all inlets and outlets)

Describe:



MANHOLE OBSERVATION SHEET

Location/Street Edge Railroad/Cross Country M.H. OBS. 0420 / _____

PROJECT NO.: 11070	DATE: 12/20/12
PROJECT: Middlebury Exchange Street Manhole Inspections	TIME: 1127
INSPECTOR: Kevin J. Camara, P.E.	

LOCATION IN:

- Bit. Pavement ☐
- Grass/Lawn ☐
- Gravel ☐
- Other ☒
- Woods

TYPE OF MANHOLE:

- Precast ☒
- Block ☐
- Brick ☐
- Inside Drop ☐
- Outside Drop ☐

FRAME & COVER:

Drain Holes? Y (N) How Many? ____
Material: CI ☒ Concrete ☐ Other ☐ _____
Cover Size: 24" Diameter or _____ x _____
Clear Opening 22" Diameter or _____ x _____
Mortared? Y (N) Centered? (Y) N
General Condition:
Good.

INVERT:

Uniform ☐ Non-Uniform ☒
Smooth ☐ Rough ☒
Solids Accumulated? Y N
Brick ☐ Concrete ☒ PVC ☐
Describe:
Good condition.
Minor deterioration

RISERS AND JOINTS:

Flat Top _____
Conical Top 1
No. of Risers 1
Base 1
Mortared _____
Other _____

LADDER RUNGS:

Aluminum ☒
Iron ☐
Plastic ☐
Appear Safe? Y N
Other:
Coated with slime

DIMENSIONS:

Depth 10'-2" +/- (Rim to Invert)
Inside Dia. 4'-0"
Inside Dimensions: _____ x _____
Other:

SHELF: None ☐ Mortar ☒ Brick ☐ Sloped ☒ Smooth ☐ Rough ☐
Describe: Minor spalling and biofilm

NOTICEABLE DEFICIENCIES:

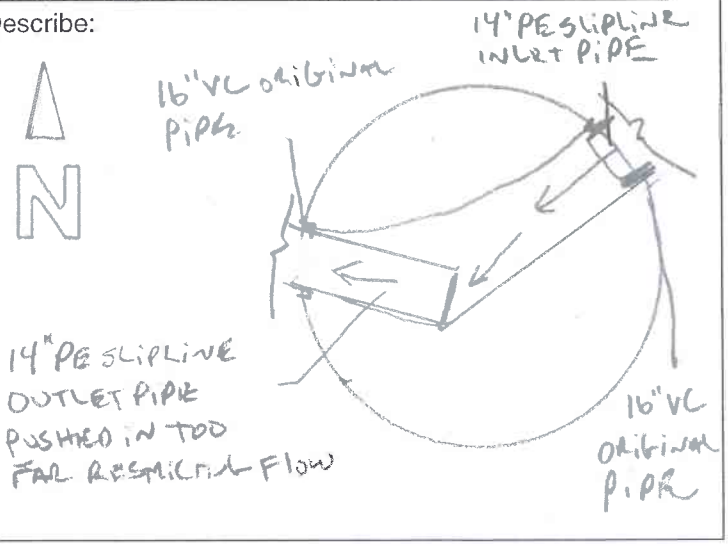
GRIT? Y (N) Amount: _____
CLEANLINESS: (Y) N Describe: Minor biofilm on walls.
EXTRANEOUS WATER? (Y) N Quantity: Weeps Location: Riser joints
CRACKS? Y (N) Describe:
Evidence of Surcharging? Y (N)
Lift Holes Plugged? (Y) N

OTHER COMMENTS AND REMARKS:

Outlet 14" PE pipe pushed in too far causing Restriction of flow.

Minor deterioration/spalling of concrete walls.

DIAGRAM: (Show location & size of all inlets and outlets)
Describe:



MANHOLE OBSERVATION SHEET

Location/Street Edge Railroad/Cross Country M.H. OBS. 0421 / _____

PROJECT NO.: 11070	DATE: 12/20/12
PROJECT: Middlebury Exchange Street Manhole Inspections	TIME: 1136
INSPECTOR: Kevin J. Camara, P.E.	

LOCATION IN:

Bit. Pavement	☐
Grass/Lawn	☒
Gravel	☐
Other	☐

TYPE OF MANHOLE:

Precast	☒
Block	☐
Brick	☐
Inside Drop	☒
Outside Drop	☐

FRAME & COVER:

Drain Holes? Y (N) How Many? ____
Material: CI ☒ Concrete ☐ Other ☐ _____
Cover Size: 24" Diameter or _____ x _____
Clear Opening 22" Diameter or _____ x _____
Mortared? Y N Centered? Y N
General Condition:
Good.

INVERT:

Uniform ☐ Non-Uniform ☒
Smooth ☐ Rough ☒
Solids Accumulated? Y N
Brick ☐ Concrete ☒ PVC ☐
Describe:
Good condition.
Minor solids.

RISERS AND JOINTS:

Flat Top _____
Conical Top 1
No. of Risers 2
Base 1
Mortared _____
Other _____

LADDER RUNGS:

Aluminum ☒
Iron ☐
Plastic ☐
Appear Safe? Y N
Other:
Coated with slime

DIMENSIONS:

Depth 12'-2" +/- (Rim to Invert)
Inside Dia. 4'-0"
Inside Dimensions:
_____ x _____
Other:

SHELF: None ☐ Mortar ☒ Brick ☐ Sloped ☒ Smooth ☐ Rough ☐
Describe: Minor spalling and biofilm

NOTICEABLE DEFICIENCIES:

GRIT? (Y) N Amount: Invert ¼ full
CLEANLINESS: Y (N) Describe: Minor biofilm on walls.
EXTRANEOUS WATER? (Y) N Quantity: 10 gpm Location: Inlet side between outer pipe and slip line pipe.
CRACKS? (Y) N Describe: MH Walls.
Evidence of Surcharging? (Y) N
Lift Holes Plugged? (Y) N

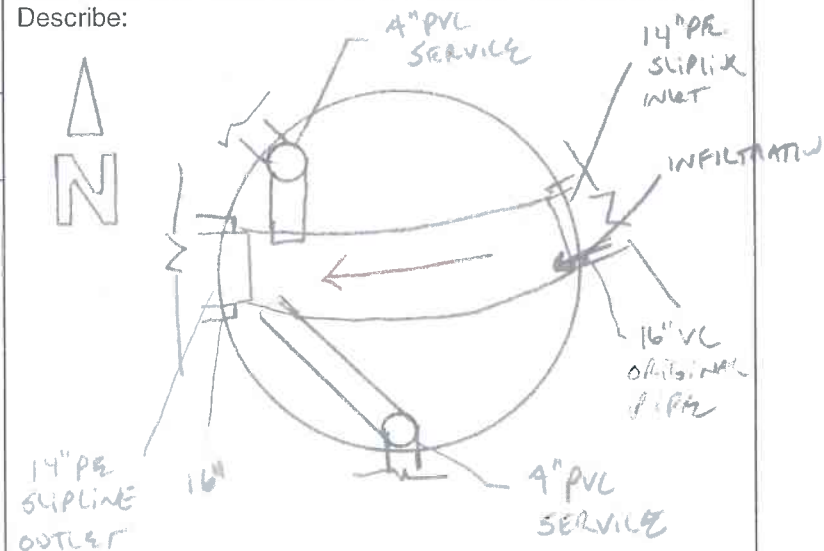
OTHER COMMENTS AND REMARKS:

Outlet 14" PE pipe pushed in too far causing Restriction of flow.

Minor deterioration/spalling of concrete walls and roots.

DIAGRAM: (Show location & size of all inlets and outlets)

Describe:



MANHOLE OBSERVATION SHEET

Location/Street Edge Railroad/Cross Country M.H. OBS. 0759 / _____

PROJECT NO.: 11070	DATE: 12/20/12
PROJECT: Middlebury Exchange Street Manhole Inspections	TIME: 0905
INSPECTOR: Kevin J. Camara, P.E.	

LOCATION IN:

- Bit. Pavement ☐
- Grass/Lawn ☐
- Gravel ☐
- Other ☒
- Woods

TYPE OF MANHOLE:

- Precast ☒
- Block ☐
- Brick ☐
- Inside Drop ☐
- Outside Drop ☐

FRAME & COVER:

Drain Holes? Y (N) How Many? ____
Material: CI ☒ Concrete ☐ Other ☐ _____
Cover Size: 24" Diameter or _____ x _____
Clear Opening 22" Diameter or _____ x _____
Mortared? (Y) N Centered? (Y) N
General Condition:
Good.

INVERT:

Uniform ☒ Non-Uniform ☐
Smooth ☒ Rough ☐
Solids Accumulated? Y N
Brick ☐ Concrete ☒ PVC ☐
Describe:

RISERS AND JOINTS:

Flat Top _____
Conical Top 1
No. of Risers _____
Base 1
Mortared _____
Other _____

LADDER RUNGS:

Aluminum ☒
Iron ☐
Plastic ☐
Appear Safe? Y N
Other:
Coated with slime

DIMENSIONS:

Depth 9'-0" +/- (Rim to Invert)
Inside Dia. 4'-0"
Inside Dimensions: _____ x _____
Other:

SHELF: None ☐ Mortar ☒ Brick ☐ Sloped ☒ Smooth ☐ Rough ☒
Describe:

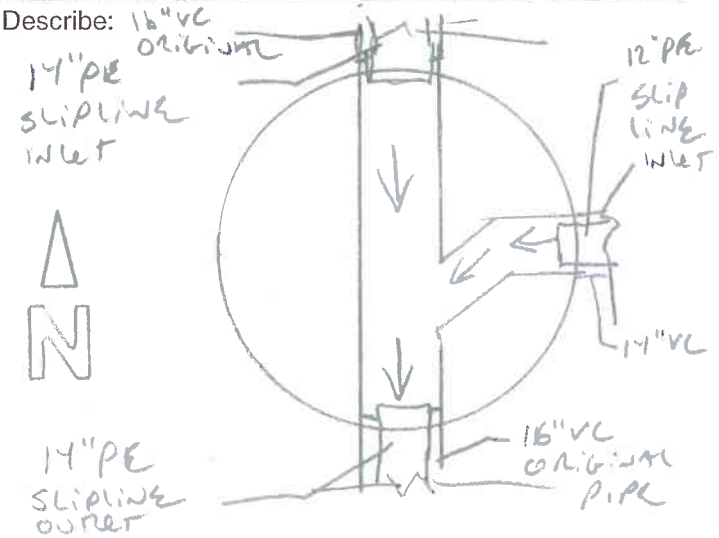
NOTICEABLE DEFICIENCIES:

Evidence of Surcharging? (Y) N
GRIT? (Y) N Amount: invert ½ full Lift Holes Plugged? (Y) N
CLEANLINESS: Y (N) Describe: Entire manhole wall has significant slime growth. Minor spalling of concrete walls
EXTRANEOUS WATER? Y (N) Quantity: _____ Location: _____
CRACKS? Y (N) Describe:

OTHER COMMENTS AND REMARKS:

DIAGRAM: (Show location & size of all inlets and outlets)

Describe:



MANHOLE OBSERVATION SHEET

Location/Street Edge Railroad/Cross Country M.H. OBS. 0759A / _____

PROJECT NO.: 11070	DATE: 12/20/12
PROJECT: Middlebury Exchange Street Manhole Inspections	TIME: 0921
INSPECTOR: Kevin J. Camara, P.E.	

LOCATION IN:

- Bit. Pavement ☐
- Grass/Lawn ☐
- Gravel ☐
- Other ☒
- Woods

TYPE OF MANHOLE:

- Precast ☒
- Block ☐
- Brick ☐
- Inside Drop ☐
- Outside Drop ☐

FRAME & COVER:

Drain Holes? Y N How Many? ____
Material: CI ☒ Concrete ☐ Other ☐ _____
Cover Size: 24" Diameter or _____ x _____
Clear Opening 22" Diameter or _____ x _____
Mortared? Y N Centered? Y N
General Condition: Good.

INVERT:

Uniform ☒ Non-Uniform ☐
Smooth ☐ Rough ☒
Solids Accumulated? Y N
Brick ☒ Concrete ☐ PVC ☐
Describe: Invert deteriorated.

RISERS AND JOINTS:

Flat Top _____
Conical Top 1
No. of Risers _____
Base 1
Mortared _____
Other _____

LADDER RUNGS:

Aluminum ☒
Iron ☐
Plastic ☐
Appear Safe? Y N
Other: Coated with slime

DIMENSIONS:

Depth 6'-7" +/- (Rim to Invert)
Inside Dia. 4'-0"
Inside Dimensions: _____ x _____
Other: _____

SHELF: None ☐ Mortar ☒ Brick ☐ Sloped ☒ Smooth ☐ Rough ☒
Describe: Mortar deteriorated and concrete spalling.

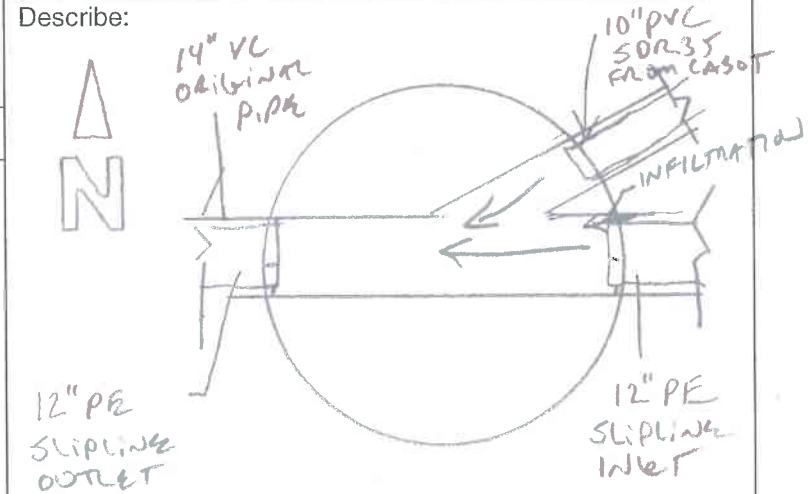
NOTICEABLE DEFICIENCIES:

GRIT? (Y) N Amount: invert ½ full
CLEANLINESS: Y (N) Describe: Entire manhole wall has significant slime growth. Minor spalling of concrete walls. Significant root growth on walls.
EXTRANEOUS WATER? (Y) N Quantity: <1gpm Location: Inlet pipe connection.
CRACKS? Y (N) Describe:
Evidence of Surcharging? Y N
Lift Holes Plugged? Y N

OTHER COMMENTS AND REMARKS:

Inlet pipe leaking between 12" PE slipline and 14" original pipe.

DIAGRAM: (Show location & size of all inlets and outlets)
Describe:



MANHOLE OBSERVATION SHEET

Location/Street Edge Railroad/Cross Country M.H. OBS. 0780 / _____

PROJECT NO.: 11070	DATE: 12/20/12
PROJECT: Middlebury Exchange Street Manhole Inspections	TIME: 0934
INSPECTOR: Kevin J. Camara, P.E.	

LOCATION IN:

Bit. Pavement	☐
Grass/Lawn	☐
Gravel	☐
Other	☒
Woods	

TYPE OF MANHOLE:

Precast	☒
Block	☐
Brick	☐
Inside Drop	☐
Outside Drop	☐

FRAME & COVER:

Drain Holes? Y N How Many? ____
Material: CI ☒ Concrete ☐ Other ☐ _____
Cover Size: 24" Diameter or _____ x _____
Clear Opening 22" Diameter or _____ x _____
Mortared? Y (N) Centered? (Y) N
General Condition:
Biological slime on inside.

INVERT:

Uniform ☐ Non-Uniform ☒
Smooth ☐ Rough ☒
Solids Accumulated? Y N
Brick ☐ Concrete ☒ PVC ☐
Describe:
Invert deteriorated and spalling.

RISERS AND JOINTS:

Flat Top	
Conical Top	1
No. of Risers	1
Base	1
Mortared	
Other	

LADDER RUNGS:

Aluminum	☒
Iron	☐
Plastic	☐

Appear Safe? Y N
Other:
Coated with slime

DIMENSIONS:

Depth 9'-2" +/- (Rim to Invert)
Inside Dia. 4'-0"
Inside Dimensions: _____ x _____
Other:

SHELF: None ☐ Mortar ☒ Brick ☐ Sloped ☒ Smooth ☐ Rough ☒
Describe: Mortar deteriorated and concrete spalling.

NOTICEABLE DEFICIENCIES:

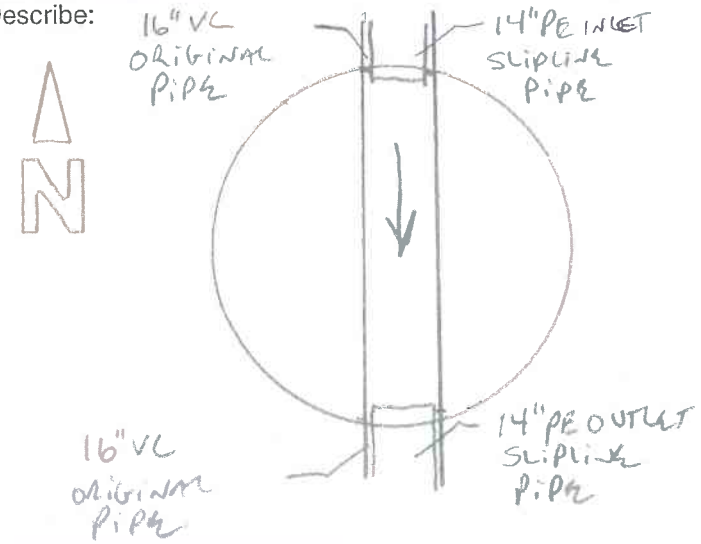
GRIT? Y (N) Amount: _____
CLEANLINESS: (Y) N Describe: Manhole walls covered in bacterial slime growth.
EXTRANEOUS WATER? (Y) N Quantity: Weeping Location: At both pipe connections and base/riser joint.
CRACKS? (Y) N Describe:
Evidence of Surcharging? (Y) N
Lift Holes Plugged? (Y) N

OTHER COMMENTS AND REMARKS:

Inlet pipe leaking between 12" PE slipline and 14" original pipe.

DIAGRAM: (Show location & size of all inlets and outlets)

Describe:



MANHOLE OBSERVATION SHEET

Location/Street Edge Railroad/Cross Country M.H. OBS. 0780A / _____

PROJECT NO.: 11070	DATE: 12/20/12
PROJECT: Middlebury Exchange Street Manhole Inspections	TIME: 0934
INSPECTOR: Kevin J. Camara, P.E.	

LOCATION IN:

- Bit. Pavement ☐
- Grass/Lawn ☐
- Gravel ☐
- Other ☒
- Woods

TYPE OF MANHOLE:

- Precast ☒
- Block ☐
- Brick ☐
- Inside Drop ☐
- Outside Drop ☐

FRAME & COVER:

Drain Holes? Y (N) How Many? ____
Material: CI ☒ Concrete ☐ Other ☐ _____
Cover Size: 24" Diameter or _____ x _____
Clear Opening 22" Diameter or _____ x _____
Mortared? (Y) N Centered? (Y) N
General Condition:
Biological slime on inside.

INVERT:

Uniform ☐ Non-Uniform ☒
Smooth ☐ Rough ☒
Solids Accumulated? Y N
Brick ☐ Concrete ☒ PVC ☐
Describe:
Invert deteriorated, spalling and significant slime growth.

RISERS AND JOINTS:

Flat Top _____
Conical Top 1
No. of Risers 1
Base 1
Mortared _____
Other _____

LADDER RUNGS:

Aluminum ☒
Iron ☐
Plastic ☐
Appear Safe? Y N
Other:
Coated with slime

DIMENSIONS:

Depth 9'-2" +/- (Rim to Invert)
Inside Dia. 4'-0"
Inside Dimensions: _____ x _____
Other:

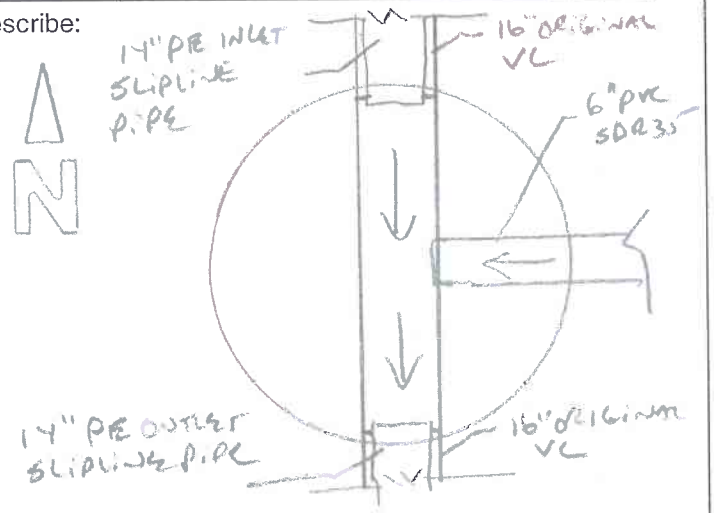
SHELF: None ☐ Mortar ☒ Brick ☐ Sloped ☒ Smooth ☐ Rough ☒
Describe: Mortar deteriorated and concrete spalling.

NOTICEABLE DEFICIENCIES:

GRIT? Y (N) Amount: _____
CLEANLINESS: (Y) N Describe: Manhole walls covered in bacterial slime growth.
EXTRANEOUS WATER? (Y) N Quantity: 5 gpm Location: Hole in MH Wall and under frame.
CRACKS? (Y) N Describe: Hole in MH Wall.
Evidence of Surcharging? Y (N)
Lift Holes Plugged? (Y) N

OTHER COMMENTS AND REMARKS:

DIAGRAM: (Show location & size of all inlets and outlets)
Describe:



APPENDIX G

WET WELL SKETCHES

24" DI INV. IN=327.53'
(BRICK AND MORTAR AFTER GRIT REMOVAL SYSTEM IS ONLINE)
24" DI INV. OUT=327.53'

PROTECT EXISTING 24" INFLUENT SEWER LINE FOR CONSTRUCTION OF NEW GRIT REMOVAL BUILDING. SHEETING MAY BE REQUIRED

EXISTING 24" INFLUENT SEWER TO REMAIN IN SERVICE

24" DI INV.=327.75'

STONE DRIP EDGE (C/C6)

BIOFILTER TO REMAIN

SMH #123
RIM=328.46'
6" PVC INV. IN=324.75'
24" DI INV. IN=324.00'
18" DI INV. IN=324.00'
18" DI INV. IN=324.00'
24" DI INV. OUT=324.00'

NEW GRIT REMOVAL BUILDING

PAVEMENT

INSTALL NEW CB# 1-A
RIM=331.00'
12" HDPE INV. OUT=

24" DI INV.=327.64'

2" ABANDONED

330.0'

329.5'

NEW CLEANOUT (TYP.) (Q/C7)

BOLLARD (TYP.) (D/C6)

329.5'

331.5'

329.4'

TRENCH PAVEMENT REPAIR (TYP.) (B/C6)

NEW HYDRANT (B/C9)

NEW PAVED DRIVEWAY (A/C6)

RELOCATE EXISTING WATERLINE

2" HDPE CTS CL200

CURBSTOP (TYP.)

SILT FENCE (TYP.) (A/C9)

SDMH #1
RIM=328.10'
6" PVC INV. IN=319.00'
36" RCP INV. IN=321.10'
12" PVC INV. IN=323.29'
36" RCP INV. OUT=318.67'

CB #2
RIM=327.54'
12" PVC INV. OUT=323.51'

BM#1
CHISEL SQUARE
ELEV.=328.40'

F.F. ELEV.=329.77'

F.F. ELEV.=328.62'

MAIN PUMP STATION

GENERATOR

WET WELL

CUT AND CAP EXISTING LINE (TYP.)

SMH #110B
RIM=335.38'
8" PVC INV. IN=326.13'
8" PVC INV. IN=326.13'
30" PVC INV. IN=328.96'
30" PVC INV. OUT=328.96'

CB #3
RIM=329.59'
18" CMP INV. OUT=325.09'

8"X6" REDUCER

8"X8" TEE

THRUST RESTRAINT

CUT AND CAP EXISTING 6" DI WATER LINE

CB #1
RIM=328.26'
12" HDPE INV. IN=324.00'
15" RCP INV. OUT=323.70'

330.1'

1+88

EXISTING STORM DRAIN TO BE REMOVED

NEW WET WELL

NEW CB (E/C7)
RIM=328.50'
INV.=326.7'±

GENERATOR STORAGE BUILDING

METER VAULT

ABANDONED CHLORINE BUILDING

A PORTION OF ABANDONED CHLORINE BUILDING CONCRETE WALLS TO BE REMOVED FOR NEW WET WELL

ABANDONED GRIT CHAMBER

ABANDONED PRIMARY SETTLING TANK – EXISTING CAST-IN-PLACE CONCRETE WALLS AND BASE SLAB TO BE REMOVED – REFER TO DRAWING No. C5

330.1'

NEW CLEANOUT (TYP.) (Q/C7)

1+49

SMH 119F
RIM=331.71'
24" DI INV. IN=324.03'
24" DI INV. OUT=320.30'

SMH 119E
RIM=333.00'
24" DI INV. IN=324.23'
24" DI INV. OUT=324.13'

SMH 119H
RIM=328.02'
24" DI INV. IN=319.28'
24" DI INV. OUT=319.18'

SMH 119G
RIM=331.86'
24" DI INV. IN=319.44'
24" DI INV. OUT=319.34'

SMH 119D
RIM=328.53'
24" DI INV. IN=324.41'
24" DI INV. OUT=324.31'

SMH 119C
RIM=330.79'
24" DI INV. IN=326.52'
24" DI INV. OUT=324.44'

REMOVE 90° ELBOW AND INSTALL NEW 24"X24" TEE (MJ)
INV.=324.40'

P-1 P-2 P-3 P-4 P-5 P-6 P-7 P-8 P-9 P-10 P-11 P-12 P-13 P-15 SB-1 SB-2 SB-3 B-4

PLAN
SCALE: 1"=10'

NOTES:

1. REFER TO DRAWING No. E2 FOR BURIED CONDUITS.

FA&A
FORCIER ALDRICH & ASSOCIATES

STATE OF VERMONT
ELIZABETH A. ELLIOTT
No. 010885
CIVIL
LICENSED PROFESSIONAL ENGINEER

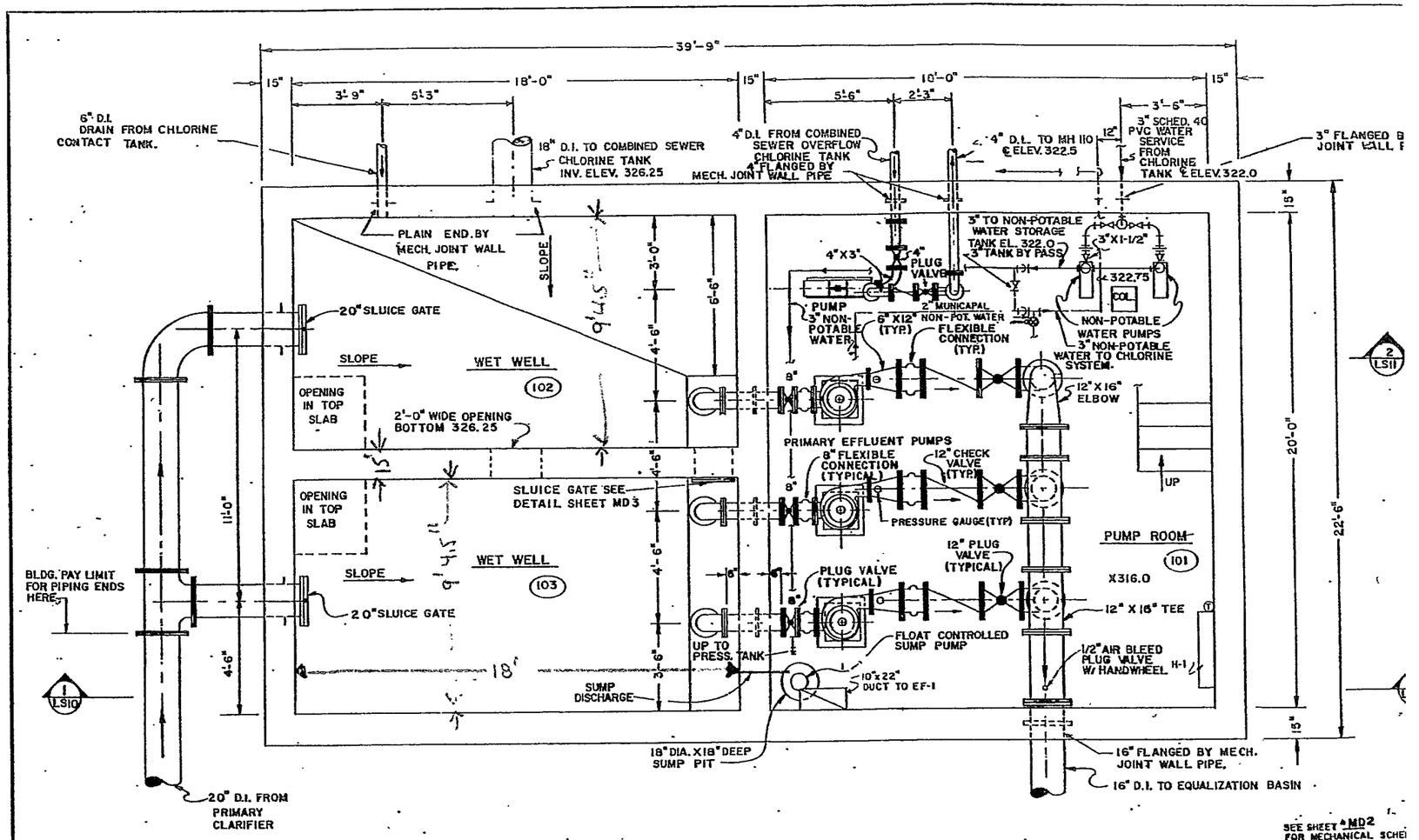
TOWN OF MIDDLEBURY
MIDDLEBURY, VERMONT

MAIN PUMPING STATION WET WELL
EXPANSION AND NEW GRIT REMOVAL
SYSTEM CONTRACT No. 1

NO.	DATE	REVISION DESCRIPTION	CHECKED

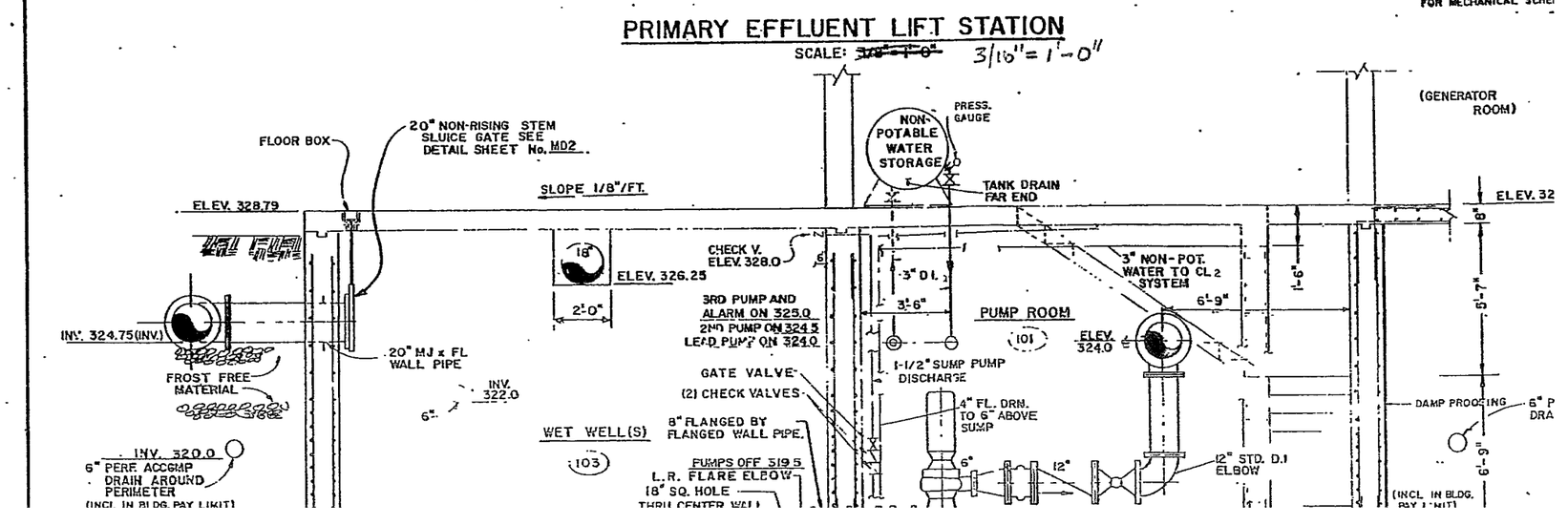
PROPOSED SITE AND YARD PIPING PLAN

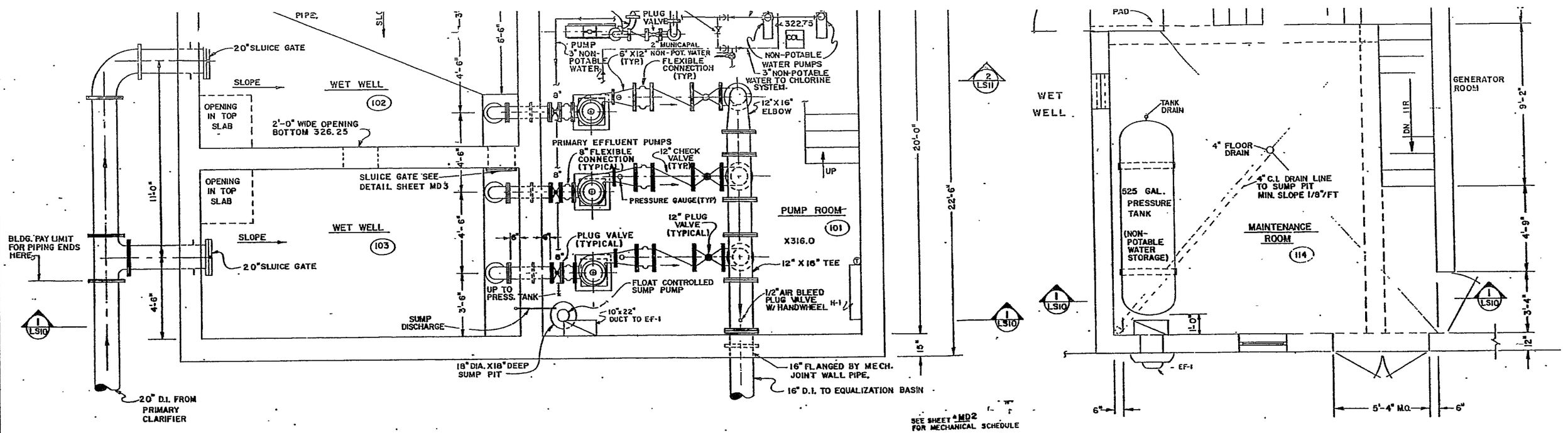
DESIGNED KJC	PROJECT NO. 09082
DRAWN JEB	DRAWING NO. C3
CHECKED WAE	
DATE DEC. 2009	SHEET 4



PRIMARY EFFLUENT LIFT STATION

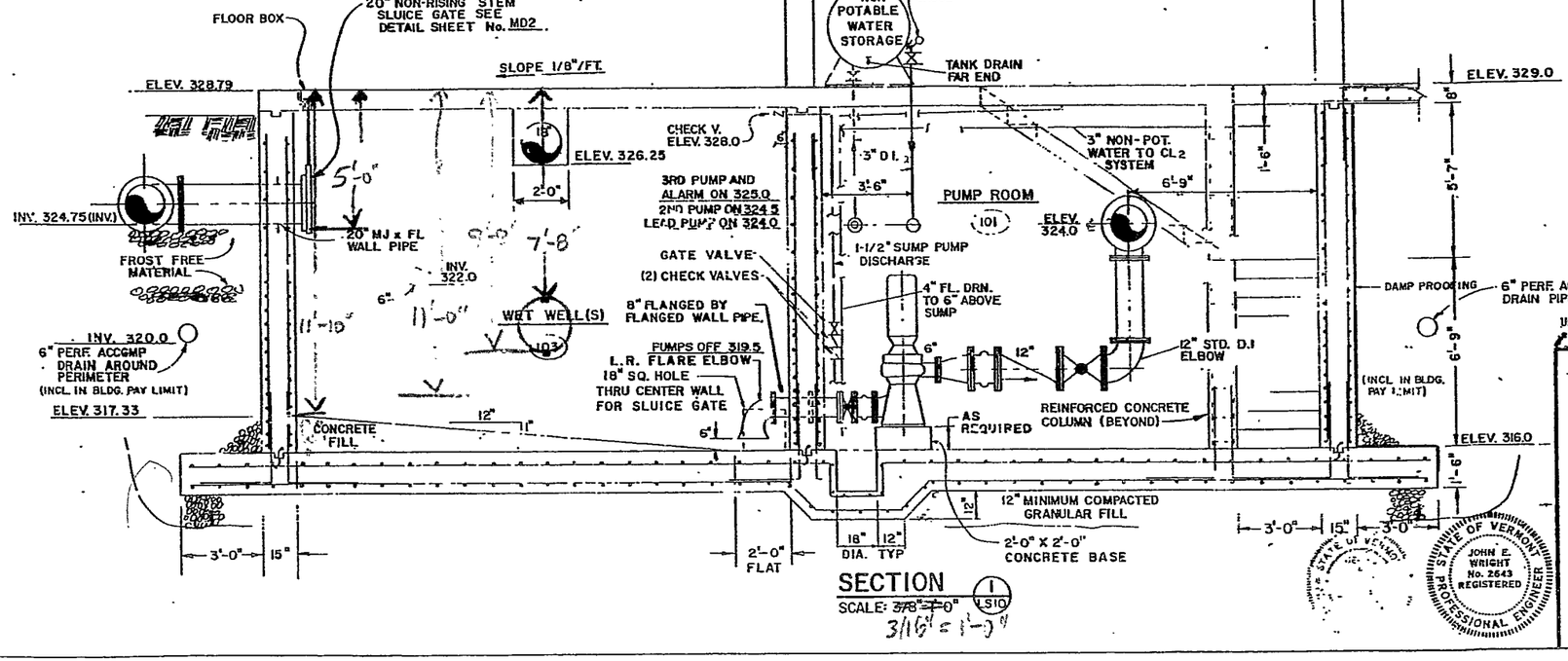
SCALE: ~~3/8"=1'-0"~~ 3/16"= 1'-0"





PRIMARY EFFLUENT LIFT STATION

SCALE: 3/8"= 1'-0"



SECTION

(1 / LS10)

SCALE: ~~3/8"=1'-0"~~ 3/16" = 1'-0"

(GENERATOR ROOM)

NOTE: OPENING IN FLOOR SLAB SHALL BE 2" LARGER N DIA. THAN PIPES.

TOP FLOOR

SCALE: 3/8"= 1'-0"

NOTES:

(1) CONTRACTOR SHALL FURNISH AND INSTALL 3/8" COPPER TUBING WITH SHUT-OFF VALVE AND FILTER FROM THE NON-POTABLE WATER SUPPLY OR PUMP DISCHARGE TO EACH PUMP SPECIFIED WITH WATER SEAL RINGS.

(2) BLDG. PAY LIMITS FOR PIPING TO TERMINATE AT OUTSIDE FDN. WALLS EXCEPT AS OTHERWISE SHOWN ON SHTS. LS-1, LS-7 & LS-10.

Unless otherwise noted on the plans, all 90° elbows shall be long radius.

Revision No.	Date	Description
5	3/9/79	OMIT 2" PVC, ADD 2" NON-POTABLE WATER
4	12/27/78	ADD SUMP PIT TO SECT 1 & TANK DRAIN TO PRESSURE TANK, OMIT ROOF VENT REV FLR DRAIN IN RM 114 & NON-POTABLE WATER LAYOUT..
3	10/19/78	ADD ROOM NO'S.
2	8/18/78	ADD PIPE DESCRIPT & ROOM TITLES, OMIT SLUDGE PUMP FROM MAINT. RM.
1	5/31/78	ADD BLDG. PAY LIMIT & NOTE 2.

CONSULTING ENGINEERS ARCHITECTS, PLANNERS Columbus, Indiana Madison, Indiana Delaware, Ohio

WRIGHT ENGINEERING

RUTLAND, VERMONT 05701

STATE OF VERMONT JOHN E. WRIGHT No. 2643 REGISTERED PROFESSIONAL ENGINEER

TOWN of MIDDLEBURY, VERMON
WATER POLLUTION CONTROL PROJ
EPA C500140-02

DIVISION I-SEWAGE TREATMENT PLANT UPGF

PRIMARY EFFLUENT LIFT STATION
MECHANICAL PLAN AND SECTION

Drawn By: M.D.HUGHES	Date 5-'77	Scale	Engr's Job No.	Sheet
Approved By: C.D.Hall JR	Date 12/22/77	AS NOTED	7700 (32180)	LS
Certified By: J.E. Wright	Date 12/22/77			

328.00
324.0
9.67 = 9' - 3" - 2' DIMEN = 7'-8"

APPENDIX H

WET WELL DRAWDOWN VOLUME CALCULATIONS

Aldrich + Elliott
WATER RESOURCE ENGINEERS
6 Market Place, Suite 2
Essex Junction, VT 05452
Tel 802.879.7733 www.AEengineers.com

JOB MIDDLEBURY MAIN PUMP STATION
PUMP CAPACITY TESTING
SHEET NO. 1 OF 1
CALCULATED BY KJC DATE 8/26/12
CHECKED BY WAE DATE
SCALE

DRAW DOWN VOLUME CALCULATIONS

ORIGINAL WET WELL VOLUME (2 ea. WET WELLS)

See ATTACHMENT NO.1 FOR DRAWINGS (18' x 9.375' each)

$V = 2 \times 18' \times 9.375' \times 1' = 337.5 \frac{FT^3}{FT} \times 7.48 \, GAL/FT^3 = \underline{2,524 \, GAL/FT}$

Manhole Volume (2 ea., 60" ID)

- Manhole volume is USED ABOVE ELEVATION 320.4' when manholes are SURCHARGED above SHELF.

$V = 2\pi r^2 h = 2\pi (2.5 FT)^2 (1 FT) = 39.3 \frac{FT^3}{FT} \times 7.48 \frac{GAL}{FT^3} = \underline{293 \, GAL/FT}$

Pipe volume. (24" pipe, 101 FT Length)

- Top of pipe elevation = 321.12
- Bottom Pipe Elev. = 319.12

$V = \pi r^2 L = \pi (1 FT)^2 (101 FT) = 317 FT^3 \times 7.48 \frac{GAL}{FT^3} = \underline{2,373 \, GAL}$

APPENDIX I

1ST ROUND DRAWDOWN CAPACITY CALCULATIONS

Town of Middlebury
Main Wastewater Pump Station
Pump Drawdown Testing

Date: 8/29/2012
Project No.: 11070
Persons Present: Kevin J. Camara, P.E., Bob Wells, Jerry Skira

Pump 1 High Speed

Run Time (min:sec)	Run Time (min)	Interval Time (min.)	Depth from Top of Hatch (in)	Dist. Hatch to TOC (ft)	Elev. TOC (ft)	Liquid Elevation (ft)	Interval Height (ft)	Volume/FT Wetwell (gal/ft)	Volume/FT MH (gal/ft)	Volume/FT Pipe (gal/ft)	Total Volume/FT (gal/ft)	Total Volume/ Interval (gal)	Drawdown Flow Rate (gpm)	Fill Flow Rate (gpm)		Drawdown + Fill Flow Rate (gpm)	(MGD)	Flowmeter Reading (MGD)	(gpm)
0:00	0.00	0.00	64	1	328.79	324.46	0.00												
0:22	0.37	0.37	70	1	328.79	323.96	0.50	2,524	293	0	2,817	1,409	3,841		126	3,967	5.71	3.32	2,306
0:56	0.93	0.57	76	1	328.79	323.46	0.50	2,524	293	0	2,817	1,409	2,486		126	2,612	3.76	3.23	2,243
1:22	1.37	0.43	82	1	328.79	322.96	0.50	2,524	293	0	2,817	1,409	3,250		126	3,376	4.86	3.18	2,208
1:57	1.95	0.58	88	1	328.79	322.46	0.50	2,524	293	0	2,817	1,409	2,415		126	2,541	3.66	3.14	2,181
2:32	2.53	0.58	94	1	328.79	321.96	0.50	2,524	293	202	3,019	1,510	2,588		126	2,714	3.91	3.10	2,153
3:07	3.12	0.58	100	1	328.79	321.46	0.50	2,524	293	1,186	4,003	2,002	3,431		126	3,557	5.12	3.07	2,132
3:49	3.82	0.70	106	1	328.79	320.96	0.50	2,524	293	1,186	4,003	2,002	2,859		126	2,985	4.30	3.06	2,125
4:48	4.80	0.98	112	1	328.79	320.46	0.50	2,524	0	1,186	3,710	1,855	1,886		126	2,012	2.90	3.05	2,118
5:34	5.57	0.77	118	1	328.79	319.96	0.50	2,524	0	1,186	3,710	1,855	2,420		126	2,546	3.67	3.03	2,104
6:15	6.25	0.68	124	1	328.79	319.46	0.50	2,524	0	403	2,927	1,464	2,142		126	2,268	3.27	3.01	2,090
6:48	6.80	0.55	130	1	328.79	318.96	0.50	2,524	0	0	2,524	1,262	2,295		126	2,421	3.49	3.02	2,097
												Average	2,732		126	2,858	4.12	3.12	2,166
Fill																			
0:00	0	0.00	134.75	1	328.79	318.56	0.00	2,524	0	0	2,524	0							
2:12	2.20	2.20	133	1	328.79	318.71	0.15	2,524	0	0	2,524	368	167						
3:25	3.42	1.22	132.25	1	328.79	318.77	0.06	2,524	0	0	2,524	158	130						
5:00	5	1.58	131.63	1	328.79	318.82	0.05	2,524	0	0	2,524	130	82						
												Average	126						

Overall Volume

Run Time (min)	Interval Height (ft)	Volume/FT Wetwell (gal/ft)	Volume/FT MH (gal/ft)	Volume/Full Pipe Pipe (gal)	Total Volume (gal)	Drawdown Flow Rate (gpm)	Fill Flow Rate (gpm)		Drawdown + Fill Flow Rate (gpm)	(MGD)	Flowmeter Reading (MGD)	(gpm)
6.80	5.50	2524	293	2,373								
	Drawdown Interval (ft or Pipe)	5.50	4.0	1								
	Drawdown Volume (gal)	13,882	1,159	2,373	17,414	2,561		126	2,687	3.87	3.12	2,166

Top of Pipe from New Wet Well=	321.12
Bottom of Pipe from New Wet Well=	319.12
MH 119H Shelf	320.4
MH 119G Shelf	320.5

Town of Middlebury
Main Wastewater Pump Station
Pump Drawdown Testing

Date: 8/29/2012
Project No.: 11070
Persons Present: Kevin J. Camara, P.E., Bob Wells, Jerry Skira

Pump 2 High Speed

Run Time (min:sec)	Run Time (min)	Interval Time (min.)	Depth from Top of Hatch (in)	Dist. Hatch to TOC (ft)	Elev. TOC (ft)	Liquid Elevation (ft)	Interval Height (ft)	Volume/FT Wetwell (gal/ft)	Volume/FT MH (gal/ft)	Volume/FT Pipe (gal/ft)	Total Volume/FT (gal/ft)	Total Volume/ Interval (gal)	Drawdown Flow Rate (gpm)	Drawdown Flow Rate (MGD)	Flowmeter Reading (MGD)	Flowmeter Reading (gpm)
0:00	0.00	0.00	72.25	1	328.79	323.77	0.00									
0:42	0.70	0.70	78	1	328.79	323.29	0.48	2,524	293	0	2,817	1,350	1,928	2.78	3.27	2,271
1:11	1.18	0.48	84	1	328.79	322.79	0.50	2,524	293	0	2,817	1,409	2,914	4.20	3.12	2,167
1:43	1.72	0.53	90	1	328.79	322.29	0.50	2,524	293	0	2,817	1,409	2,641	3.80		
2:17	2.28	0.57	96	1	328.79	321.79	0.50	2,524	293	0	2,817	1,409	2,486	3.58	3.07	2,132
2:44	2.73	0.45	102	1	328.79	321.29	0.50	2,524	293	202	3,019	1,510	3,354	4.83		
3:16	3.27	0.53	106	1	328.79	320.96	0.33	2,524	293	1,186	4,003	1,334	2,502	3.60	3.02	2,097
4:09	4.15	0.88	112	1	328.79	320.46	0.50	2,524	293	1,186	4,003	2,002	2,266	3.26		
4:46	4.77	0.62	116	1	328.79	320.12	0.33	2,524	0	1,186	3,710	1,237	2,005	2.89	2.96	2,056
5:10	5.17	0.40	120	1	328.79	319.79	0.33	2,524	0	1,186	3,710	1,237	3,092	4.45	3.00	2,083
5:44	5.73	0.57	126	1	328.79	319.29	0.50	2,524	0	403	2,927	1,464	2,583	3.72	2.99	2,076
6:05	6.08	0.35	130	1	328.79	318.96	0.33	2,524	0	0	2,524	841	2,404	3.46	2.99	2,076
												Average	2,561	3.69	3.05	2,120

Overall Volume

Run Time (min)	Interval Height (ft)	Volume/FT Wetwell (gal/ft)	Volume/FT MH (gal/ft)	Volume/Full Pipe Pipe (gal)	Total Volume (gal)	Drawdown Flow Rate (gpm)	Drawdown Flow Rate (MGD)	Flowmeter Reading (MGD)	Flowmeter Reading (gpm)
6.08	4.81	2524	293	2,373					
	Drawdown Interval (ft or Pipe)	4.81	3.3	1					
	Drawdown Volume (gal)	12,147	958	2,373	15,478	2,544	3.66	3.05	2,120

Top of Pipe from New Wet Well=	321.12
Bottom of Pipe from New Wet Well=	319.12
MH 119H Shelf	320.4
MH 119G Shelf	320.5

Town of Middlebury
Main Wastewater Pump Station
Pump Drawdown Testing

Date: 8/29/2012
Project No.: 11070
Persons Present: Kevin J. Camara, P.E., Bob Wells, Jerry Skira

Pump 3 High Speed

Run Time (min:sec)	Run Time (min)	Interval Time (min.)	Depth from Top of Hatch (in)	Dist. Hatch to TOC (ft)	Elev. TOC (ft)	Liquid Elevation (ft)	Interval Height (ft)	Volume/FT Wetwell (gal/ft)	Volume/FT MH (gal/ft)	Volume/FT Pipe (gal/ft)	Total Volume/FT (gal/ft)	Total Volume/ Interval (gal)	Drawdown Flow Rate (gpm)	Drawdown Flow Rate (MGD)	Flowmeter Reading (MGD)	Flowmeter Reading (gpm)
0:00	0.00	0.00	66.5	1	328.79	324.25	0.00									
0:40	0.67	0.67	72	1	328.79	323.79	0.46	2,524	293	0	2,817	1,291	1,937	2.79	3.22	2,236
1:10	1.17	0.50	78	1	328.79	323.29	0.50	2,524	293	0	2,817	1,409	2,817	4.06	3.22	2,236
1:41	1.68	0.52	84	1	328.79	322.79	0.50	2,524	293	0	2,817	1,409	2,726	3.93	3.00	2,083
2:10	2.17	0.48	90	1	328.79	322.29	0.50	2,524	293	0	2,817	1,409	2,914	4.20	3.00	2,083
2:42	2.70	0.53	96	1	328.79	321.79	0.50	2,524	293	0	2,817	1,409	2,641	3.80	3.06	2,125
3:24	3.40	0.70	104	1	328.79	321.12	0.67	2,524	293	0	2,817	1,878	2,683	3.86	3.03	2,104
4:05	4.08	0.68	109	1	328.79	320.71	0.42	2,524	293	1,186	4,003	1,668	2,441	3.51	3.03	2,104
4:45	4.75	0.67	114	1	328.79	320.29	0.42	2,524	76	1,186	3,786	1,578	2,366	3.41	3.00	2,083
5:35	5.58	0.83	120	1	328.79	319.79	0.50	2,524	0	1,186	3,710	1,855	2,226	3.21	2.99	2,076
6:27	6.45	0.87	127	1	328.79	319.21	0.58	2,524	0	806	3,330	1,943	2,242	3.23	3.00	2,083
												Average	2,499	3.60	3.06	2,122

Overall Volume

Run Time (min)	Interval Height (ft)	Volume/FT Wetwell (gal/ft)	Volume/FT MH (gal/ft)	Volume/Full Pipe Pipe (gal)	Total Volume (gal)	Drawdown Flow Rate (gpm)	Drawdown Flow Rate (MGD)	Flowmeter Reading (MGD)	Flowmeter Reading (gpm)
6.45	5.04	2524	293	2,373					
Drawdown Interval (ft or Pipe)	5.04	3.9	1						
Drawdown Volume (gal)	12,725	1,129	2,373		16,227	2,516	3.62	3.06	2,122

Top of Pipe from New Wet Well=	321.12
Bottom of Pipe from New Wet Well=	319.12
MH 119H Shelf	320.4
MH 119G Shelf	320.5

Town of Middlebury
Main Wastewater Pump Station
Pump Drawdown Testing

Date: 8/29/2012
Project No.: 11070
Persons Present: Kevin J. Camara, P.E., Bob Wells, Jerry Skira

Pumps 1 & 2 High Speed

Run Time (min:sec)	Run Time (min)	Interval Time (min.)	Depth from Top of Hatch (in)	Dist. Hatch to TOC (ft)	Elev. TOC (ft)	Liquid Elevation (ft)	Interval Height (ft)	Volume/FT Wetwell (gal/ft)	Volume/FT MH (gal/ft)	Volume/FT Pipe (gal/ft)	Total Volume/FT (gal/ft)	Total Volume/ Interval (gal)	Drawdown Flow Rate (gpm)	(MGD)	Flowmeter Reading (MGD)	(gpm)
0:00	0.00	0.00	70	1	328.79	323.96	0.00									
0:35	0.58	0.58	76	1	328.79	323.46	0.50	2,524	293	0	2,817	1,409	2,415	3.48	-	
0:56	0.93	0.35	82	1	328.79	322.96	0.50	2,524	293	0	2,817	1,409	4,024	5.79	4.65	3,229
1:17	1.28	0.35	88	1	328.79	322.46	0.50	2,524	293	0	2,817	1,409	4,024	5.79	4.57	3,174
1:39	1.65	0.37	94	1	328.79	321.96	0.50	2,524	293	0	2,817	1,409	3,841	5.53	4.48	3,111
2:00	2.00	0.35	100	1	328.79	321.46	0.50	2,524	293	0	2,817	1,409	4,024	5.79	4.38	3,042
2:30	2.50	0.50	106	1	328.79	320.96	0.50	2,524	293	380	3,197	1,598	3,197	4.60	4.25	2,951
3:12	3.15	0.65	112	1	328.79	320.46	0.50	2,524	293	1,186	4,003	2,002	3,079	4.43	4.17	2,896
3:42	3.70	0.55	118	1	328.79	319.96	0.50	2,524	0	1,186	3,710	1,855	3,373	4.86	4.12	2,861
4:10	4.17	0.47	124	1	328.79	319.46	0.50	2,524	0	1,186	3,710	1,855	3,975	5.72	4.12	2,861
4:31	4.52	0.35	130	1	328.79	318.96	0.50	2,524	0	806	3,330	1,665	4,758	6.85	4.12	2,861
												Average	3,671	5.29	4.32	2,998

Overall Volume

Run Time (min)
4.52

	Interval Height (ft)	Volume/FT Wetwell (gal/ft)	Volume/FT MH (gal/ft)	Volume/Full Pipe Pipe (gal)
	5.00	2524	293	2,373
Drawdown Interval (ft or Pipe)		5.00	3.6	1
Drawdown Volume (gal)		12,620	1,044	2,373

Total Volume (gal)	Drawdown Flow Rate (gpm)	(MGD)	Flowmeter Reading (MGD)	(gpm)
16,037	3,551	5.11	4.32	3,000

Top of Pipe from New Wet Well=	321.12
Bottom of Pipe from New Wet Well=	319.12
MH 119H Shelf	320.4
MH 119G Shelf	320.5

Town of Middlebury
Main Wastewater Pump Station
Pump Drawdown Testing

Date: 8/29/2012
Project No.: 11070
Persons Present: Kevin J. Camara, P.E., Bob Wells, Jerry Skira

Pumps 1 & 3 High Speed

Run Time (min:sec)	Run Time (min)	Interval Time (min.)	Depth from Top of Hatch (in)	Dist. Hatch to TOC (ft)	Elev. TOC (ft)	Liquid Elevation (ft)	Interval Height (ft)	Volume/FT Wetwell (gal/ft)	Volume/FT MH (gal/ft)	Volume/FT Pipe (gal/ft)	Total Volume/FT (gal/ft)	Total Volume/ Interval (gal)	Drawdown Flow Rate (gpm)	(MGD)	Flowmeter Reading (MGD)	(gpm)
0:00	0.00	0.00	70.5	1	328.79	323.92	0.00									
0:32	0.53	0.53	76	1	328.79	323.46	0.46	2,524	293	0	2,817	1,291	2,421	3.49	4.85	3,368
0:52	0.87	0.33	82	1	328.79	322.96	0.50	2,524	293	0	2,817	1,409	4,226	6.08	4.67	3,243
1:12	1.20	0.33	88	1	328.79	322.46	0.50	2,524	293	0	2,817	1,409	4,226	6.08	4.59	3,188
1:35	1.58	0.38	94	1	328.79	321.96	0.50	2,524	293	0	2,817	1,409	3,674	5.29	4.49	3,118
1:56	1.93	0.35	100	1	328.79	321.46	0.50	2,524	293	0	2,817	1,409	4,024	5.79	4.40	3,056
2:24	2.40	0.47	106	1	328.79	320.96	0.50	2,524	293	380	3,197	1,598	3,425	4.93	4.30	2,986
3:07	3.12	0.72	112	1	328.79	320.46	0.50	2,524	293	1,186	4,003	2,002	2,793	4.02	4.21	2,924
3:38	3.63	0.52	118	1	328.79	319.96	0.50	2,524	0	1,186	3,710	1,855	3,590	5.17	4.19	2,910
4:05	4.08	0.45	124	1	328.79	319.46	0.50	2,524	0	1,186	3,710	1,855	4,122	5.94	4.19	2,910
4:28	4.47	0.38	130	1	328.79	318.96	0.50	2,524	0	806	3,330	1,665	4,344	6.26	4.18	2,903
												Average	3,684	5.31	4.41	3,060

Overall Volume

Run Time (min)		Interval Height (ft)	Volume/FT Wetwell (gal/ft)	Volume/FT MH (gal/ft)	Volume/Full Pipe Pipe (gal)		Total Volume (gal)	Drawdown Flow Rate (gpm)	(MGD)	Flowmeter Reading (MGD)	(gpm)
4.47		4.96	2524	293	2,373						
	Drawdown Interval (ft or Pipe)	4.96	3.5	1							
	Drawdown Volume (gal)	12,515	1,031	2,373			15,919	3,564	5.13	4.41	3,060

Top of Pipe from New Wet Well=	321.12
Bottom of Pipe from New Wet Well=	319.12
MH 119H Shelf	320.4
MH 119G Shelf	320.5

Town of Middlebury
Main Wastewater Pump Station
Pump Drawdown Testing

Date: 8/29/2012
Project No.: 11070
Persons Present: Kevin J. Camara, P.E., Bob Wells, Jerry Skira

Pumps 1 & 2 High Speed FM Bypass Open

Run Time (min:sec)	Run Time (min)	Interval Time (min.)	Depth from Top of Hatch (in)	Dist. Hatch to TOC (ft)	Elev. TOC (ft)	Liquid Elevation (ft)	Interval Height (ft)	Volume/FT Wetwell (gal/ft)	Volume/FT MH (gal/ft)	Volume/FT Pipe (gal/ft)	Total Volume/FT (gal/ft)	Total Volume/ Interval (gal)	Drawdown Flow Rate (gpm)	(MGD)
0:00	0.00	0.00	71.75	1	328.79	323.81	0.00							
0:30	0.50	0.50	76	1	328.79	323.46	0.35	2,524	293	0	2,817	998	1,995	2.87
0:48	0.80	0.30	82	1	328.79	322.96	0.50	2,524	293	0	2,817	1,409	4,695	6.76
1:08	1.13	0.33	88	1	328.79	322.46	0.50	2,524	293	0	2,817	1,409	4,226	6.08
1:29	1.48	0.35	94	1	328.79	321.96	0.50	2,524	293	0	2,817	1,409	4,024	5.79
1:48	1.80	0.32	100	1	328.79	321.46	0.50	2,524	293	0	2,817	1,409	4,448	6.40
2:16	2.27	0.47	106	1	328.79	320.96	0.50	2,524	293	380	3,197	1,598	3,425	4.93
2:56	2.93	0.67	112	1	328.79	320.46	0.50	2,524	293	1,186	4,003	2,002	3,002	4.32
3:25	3.42	0.48	118	1	328.79	319.96	0.50	2,524	0	1,186	3,710	1,855	3,838	5.53
3:50	3.83	0.42	124	1	328.79	319.46	0.50	2,524	0	1,186	3,710	1,855	4,452	6.41
4:11	4.18	0.35	130	1	328.79	318.96	0.50	2,524	0	806	3,330	1,665	4,758	6.85
												Average	3,886	5.60

Overall Volume

Run Time (min)
4.18

	Interval Height (ft)	Volume/FT Wetwell (gal/ft)	Volume/FT MH (gal/ft)	Volume/Full Pipe Pipe (gal)	Total Volume (gal)	Drawdown Flow Rate (gpm)	(MGD)
	4.85	2524	293	2,373			
Drawdown Interval (ft or Pipe)	4.85	3.4	1				
Drawdown Volume (gal)	12,252	1,001	2,373		15,626	3,735	5.38

Top of Pipe from New Wet Well=	321.12
Bottom of Pipe from New Wet Well=	319.12
MH 119H Shelf	320.4
MH 119G Shelf	320.5

Town of Middlebury
Main Wastewater Pump Station
Pump Drawdown Testing

Date: 8/29/2012
Project No.: 11070
Persons Present: Kevin J. Camara, P.E., Bob Wells, Jerry Skira

Pumps 1, 2 & 3 High Speed

Run Time (min:sec)	Run Time (min)	Interval Time (min.)	Depth from Top of Hatch (in)	Dist. Hatch to TOC (ft)	Elev. TOC (ft)	Liquid Elevation (ft)	Interval Height (ft)	Volume/FT Wetwell (gal/ft)	Volume/FT MH (gal/ft)	Volume/FT Pipe (gal/ft)	Total Volume/FT (gal/ft)	Total Volume/ Interval (gal)	Drawdown Flow Rate (gpm)	Drawdown Flow Rate (MGD)	Flowmeter Reading (MGD)	Flowmeter Reading (gpm)
0:00	0.00	0.00	71	1	328.79	323.8733	0.00									
0:32	0.53	0.53	76	1	328.79	323.4567	0.42	2,524	293	0	2,817	1,174	2,201	3.17	5.48	3,806
0:48	0.80	0.27	82	1	328.79	322.9567	0.50	2,524	293	0	2,817	1,409	5,282	7.61	5.32	3,694
1:06	1.10	0.30	88	1	328.79	322.4567	0.50	2,524	293	0	2,817	1,409	4,695	6.76	5.14	3,569
1:25	1.42	0.32	94	1	328.79	321.9567	0.50	2,524	293	0	2,817	1,409	4,448	6.40	5.06	3,514
1:44	1.73	0.32	100	1	328.79	321.4567	0.50	2,524	293	0	2,817	1,409	4,448	6.40	4.86	3,375
2:11	2.18	0.45	106	1	328.79	320.9567	0.50	2,524	293	380	3,197	1,599	3,552	5.12	4.81	3,340
2:44	2.73	0.55	112	1	328.79	320.4567	0.50	2,524	293	1,186	4,003	2,002	3,639	5.24	4.71	3,271
3:17	3.28	0.55	118	1	328.79	319.9567	0.50	2,524	0	1,186	3,710	1,855	3,373	4.86	4.70	3,264
3:41	3.68	0.40	124	1	328.79	319.4567	0.50	2,524	0	1,186	3,710	1,855	4,638	6.68	4.65	3,229
4:02	4.03	0.35	130	1	328.79	318.9567	0.50	2,524	0	806	3,330	1,665	4,758	6.85	4.60	3,194
												Average	4,103	5.91	4.93	3,426

Overall Volume

Run Time (min)	Interval Height (ft)	Volume/FT Wetwell (gal/ft)	Volume/FT MH (gal/ft)	Volume/Full Pipe Pipe (gal)	Total Volume (gal)	Drawdown Flow Rate (gpm)	Drawdown Flow Rate (MGD)	Flowmeter Reading (MGD)	Flowmeter Reading (gpm)
4.03	4.92	2524	293	2,373					
	Drawdown Interval (ft or Pipe)	4.92	3.5	1					
	Drawdown Volume (gal)	12,410	1,019	2,373	15,802	3,918	5.64	4.93	3,426

Top of Pipe from New Wet Well=	321.12
Bottom of Pipe from New Wet Well=	319.12
MH 119H Shelf	320.4
MH 119G Shelf	320.5

APPENDIX J

2ST ROUND DRAWDOWN CAPACITY CALCULATIONS AND SYSTEM CURVE

Town of Middlebury
Main Wastewater Pump Station
Pump Drawdown Testing

Date 10/11/2012
Project No 11070
Persons Present: Kevin J. Camara, P E , Bob Wells, Jerry Skira

Pump 1 Low Speed

Static Pressure 30 psi 69 feet
Pump Speed 33 Hertz
Motor Torque 13 %
RPM 994 rpm
Power 9 7 KW

Run Time (min:sec)	Run Time (min)	Interval Time (min.)	Depth from Top of Hatch (in)	Dist Hatch to TOC (ft)	Elev. TOC (ft)	Liquid Elevation (ft)	Interval Height (ft)	Volume/FT Wetwell (gal/ft)	Volume/FT MH (gal/ft)	Volume/FT Pipe (gal/ft)	Total Volume/FT (gal/ft)	Total Volume/ Interval (gal)	Drawdown Flow Rate (gpm)	Drawdown Flow Rate (MGD)	Flowmeter Reading (MGD)	Flowmeter Reading (gpm)	Discharge Pressure (psi)	Discharge Pressure (FT)
00 00	0.00	0 00	67 75	1	328 79	324.14	0.00											
03 56	3.93	3 93	74	1	328 79	323 62	0.52	2,524	293	0	2,817	1,467	373	0 54	0.42	292	31	72
07:42	7.70	3 77	80	1	328.79	323 12	0.50	2,524	293	0	2,817	1,409	374	0 54	0.41	285	30	69
11:45	11.75	4.05	86	1	328 79	322.62	0 50	2,524	293	0	2,817	1,409	348	0.50	0 39	271	30	69
15:36	15 60	3 85	92	1	328.79	322 12	0 50	2,524	293	0	2,817	1,409	366	0 53	0.37	257	30	69
19:53	19 88	4.28	98	1	328 79	321.62	0 50	2,524	293	0	2,817	1,409	329	0.47	0 36	250	30	69
26 28	26.47	6 58	104	1	328.79	321 12	0.50	2,524	147	0	2,671	1,335	203	0.29	0.32	222	30	69
												Average	332	0 48	0.38	263	30	70

Overall Volume

Run Time (min)	Interval Height (ft)	Volume/FT Wetwell (gal/ft)	Volume/FT MH (gal/ft)	Volume/Full Pipe Pipe (gal)	Total Volume (gal)	Drawdown Flow Rate (gpm)	Drawdown Flow Rate (MGD)	Flowmeter Reading (MGD)	Flowmeter Reading (gpm)	Discharge Pressure (psi)	Discharge Pressure (FT)
26 47	3.02	2524	293	2,373							
Drawdown Interval (ft or Pipe)	3 02	3.6	0								
Drawdown Volume (gal)	7,625	1,068	0		8,692	328	0.47	0.38	263	30	70

Top of Pipe from New Wet Well= 321 12
Bottom of Pipe from New Wet Well= 319 12
MH 119H Shelf 320.4
MH 119G Shelf 320.5

Flowmeter Error -20 0 %

Town of Middlebury Date: 10/11/2012
Main Wastewater Pump Station Project No 11070
Pump Drawdown Testing Persons Present: Kevin J Camara, P.E., Bob Wells, Jerry Skira

Pump 1 Medium Speed

Static Pressure: 30 psi 69 feet
Pump Speed 45 Hertz
Motor Torque 35.1 %
RPM 1350 rpm
Power 35.6 KW

Run Time (min sec)	Run Time (min)	Interval Time (min)	Depth from Top of Hatch (in)	Dist. Hatch to TOC (ft)	Elev. TOC (ft)	Liquid Elevation (ft)	Interval Height (ft)	Volume/FT Wetwell (gal/ft)	Volume/FT MH (gal/ft)	Volume/FT Pipe (gal/ft)	Total Volume/FT (gal/ft)	Total Volume/ Interval (gal)	Drawdown Flow Rate (gpm)	(MGD)	Flowmeter Reading (MGD)	(gpm)	Discharge Pressure (psi)	(FT)
00 00	0.00	0.00	73.5	1	328.79	323.67	0 00											
01:04	1.07	1 07	80	1	328.79	323 12	0 54	2,524	293	0	2,817	1,526	1,431	2.06	1.90	1,319	39	90
02 00	2.00	0 93	86	1	328.79	322.62	0.50	2,524	293	0	2,817	1,409	1,509	2 17	1.84	1,278	40	92
02·52	2.87	0.87	92	1	328.79	322 12	0.50	2,524	293	0	2,817	1,409	1,625	2.34	1 79	1,243		
03:42	3.70	0 83	98	1	328.79	321 62	0 50	2,524	293	0	2,817	1,409	1,690	2.43	1.79	1,243	40	92
04·40	4 67	0.97	104	1	328.79	321 12	0.50	2,524	293	0	2,817	1,409	1,457	2.10	1 77	1,229		
06:21	6.35	1 68	110	1	328.79	320 62	0 50	2,524	293	1,186	4,003	2,002	1,189	1.71	1 75	1,215	40	92
												Average	1,484	2 14	1.81	1,255	40	92

Overall Volume

Run Time (min)	Interval Height (ft)	Volume/FT Wetwell (gal/ft)	Volume/FT MH (gal/ft)	Volume/Full Pipe Pipe (gal)	Total Volume (gal)	Drawdown Flow Rate (gpm)	(MGD)	Flowmeter Reading (MGD)	(gpm)	Discharge Pressure (psi)	(FT)
6 35	3 04	2524	293	2,373							
Drawdown Interval (ft or Pipe)	3.04	3 2	0.30								
Drawdown Volume (gal)	7,677	927	712		9,316	1,467	2.11	1 81	1,255	40	92

Top of Pipe from New Wet Well= 321 12
Bottom of Pipe from New Wet Well= 319.12
MH 119H Shelf 320 4
MH 119G Shelf 320.5

Flowmeter Error -14.5 %

Town of Middlebury
Main Wastewater Pump Station
Pump Drawdown Testing

Date 10/11/2012
Project No : 11070
Persons Present Kevin J. Camara, P E., Bob Wells, Jerry Skira

Pump 1 High Speed

Static Pressure: 30 psi 69 feet
Pump Speed 60 Hertz
Motor Torque 62 %
RPM 1800 rpm
Power 96 KW

Run Time (min.sec)	Run Time (min)	Interval Time (min)	Depth from Top of Hatch (in)	Dist. Hatch to TOC (ft)	Elev TOC (ft)	Liquid Elevation (ft)	Interval Height (ft)	Volume/FT Wetwell (gal/ft)	Volume/FT MH (gal/ft)	Volume/FT Pipe (gal/ft)	Total Volume/FT (gal/ft)	Total Volume/ Interval (gal)	Drawdown Flow Rate (gpm)	(MGD)	Flowmeter Reading (MGD)	(gpm)	Discharge Pressure (psi)	(FT)
00.00	0 00	0 00	70.75	1	328.79	323 89	0.00											
00:42	0 70	0 70	77	1	328 79	323 37	0 52	2,524	293	0	2,817	1,467	2,096	3 02	3.18	2,208	54	125
02:05	2.08	1 38	94	1	328 79	321.96	1 42	2,524	293	0	2,817	3,991	2,885	4 15	3.12	2,167	55	127
02:37	2.62	0 53	100	1	328 79	321.46	0.50	2,524	293	0	2,817	1,409	2,641	3 80	3.07	2,132		
03:21	3 35	0.73	106	1	328.79	320.96	0 50	2,524	293	1,186	4,003	2,002	2,729	3.93	3.00	2,083	56	129
04:10	4.17	0 82	112	1	328 79	320 46	0.50	2,524	293	1,186	4,003	2,002	2,451	3 53	2.98	2,069		
05 00	5 00	0.83	118	1	328.79	319.96	0.50	2,524	0	1,186	3,710	1,855	2,226	3 21	2.98	2,069	56	129
05:36	5 60	0.60	123	1	328.79	319 54	0 42	2,524	0	1,186	3,710	1,546	2,576	3.71	2.80	1,944		
												Average	2,505	3 61	3 06	2,122	55	128

Overall Volume

Run Time (min)	Interval Height (ft)	Volume/FT Wetwell (gal/ft)	Volume/FT MH (gal/ft)	Volume/Full Pipe Pipe (gal)	Total Volume (gal)	Drawdown Flow Rate (gpm)	(MGD)	Flowmeter Reading (MGD)	(gpm)	Discharge Pressure (psi)	(FT)
5.60	4.35	2524	293	2,373							
Drawdown Interval (ft or Pipe)	4.35		3.4	0 80							
Drawdown Volume (gal)	10,990		994	1,898	13,883	2,479	3.57	3.06	2,122	55	128

Top of Pipe from New Wet Well= 321 12
Bottom of Pipe from New Wet Well= 319.12
MH 119H Shelf 320 4
MH 119G Shelf 320 5

Flowmeter Error -14.4 %

Town of Middlebury
Main Wastewater Pump Station
Pump Drawdown Testing

Date. 10/11/2012
Project No. 11070
Persons Present Kevin J. Camara, P E., Bob Wells, Jerry Skira

Pumps 1 and 2 Low Speed

Static Pressure: 30 psi 69 feet
Pump Speed 33 Hertz
Motor Torque 13 %
RPM 994 rpm
Power 9.7 KW

Run Time (min sec)	Run Time (min)	Interval Time (min.)	Depth from Top of Hatch (in)	Dist Hatch to TOC (ft)	Elev. TOC (ft)	Liquid Elevation (ft)	Interval Height (ft)	Volume/FT Wetwell (gal/ft)	Volume/FT MH (gal/ft)	Volume/FT Pipe (gal/ft)	Total Volume/FT (gal/ft)	Total Volume/ Interval (gal)	Drawdown Flow Rate (gpm)	(MGD)	Flowmeter Reading (MGD)	(gpm)	Discharge Pressure (psi)	(FT)
00 00	0 00	0.00	71 5	1	328 79	323.83	0 00											
02.59	2 98	2.98	78	1	328.79	323 29	0 54	2,524	293	0	2,817	1,526	511	0.74	0 64	444	31	72
05 29	5 48	2.50	84	1	328.79	322.79	0.50	2,524	293	0	2,817	1,409	563	0.81	0 63	438	31	72
08 00	8.00	2.52	90	1	328.79	322 29	0.50	2,524	293	0	2,817	1,409	560	0.81	0 59	410	31	72
10:40	10 67	2.67	96	1	328 79	321.79	0 50	2,524	293	0	2,817	1,409	528	0.76	0.56	389	31	72
13 59	13.98	3.32	102	1	328.79	321 29	0.50	2,524	293	0	2,817	1,409	425	0.61	0 52	361	31	72
19 19	19.32	5 33	109	1	328.79	320.71	0.58	2,524	293	1,186	4,003	2,335	438	0.63	0 48	333		
24:15	24.25	4 93	115	1	328 79	320.21	0 50	2,524	293	1,186	4,003	2,002	406	0.58	0 45	313	30	69
31 30	31.50	7 25	125	1	328.79	319.37	0.83	2,524	0	1,186	3,710	3,092	426	0.61	0 39	271		
												Average	482	0 69	0.53	370	31	71

Overall Volume

Run Time (min)	Interval Height (ft)	Volume/FT Wetwell (gal/ft)	Volume/FT MH (gal/ft)	Volume/Full Pipe Pipe (gal)	Total Volume (gal)	Drawdown Flow Rate (gpm)	(MGD)	Flowmeter Reading (MGD)	(gpm)	Discharge Pressure (psi)	(FT)
31.50	4.46	2524	293	2,373							
Drawdown Interval (ft or Pipe)	4.46		3 3	1							
Drawdown Volume (gal)	11,253		976	2,373	14,602	464	0.67	0.53	370	31	71

Top of Pipe from New Wet Well= 321 12
Bottom of Pipe from New Wet Well= 319 12
MH 119H Shelf 320.4
MH 119G Shelf 320.5

Flowmeter Error -20 2 %

Town of Middlebury
Main Wastewater Pump Station
Pump Drawdown Testing

Date: 10/11/2012
Project No.: 11070
Persons Present: Kevin J. Camara, P.E., Bob Wells, Jerry Skira

Pumps 1 and 2 Medium Speed

Static Pressure: 30 psi 69 feet
Pump Speed 45 Hertz
Motor Torque 35 1 %
RPM 1350 rpm
Power 38 KW

Run Time (min sec)	Run Time (min)	Interval Time (min.)	Depth from Top of Hatch (in)	Dist. Hatch to TOC (ft)	Elev. TOC (ft)	Liquid Elevation (ft)	Interval Height (ft)	Volume/FT Wetwell (gal/ft)	Volume/FT MH (gal/ft)	Volume/FT Pipe (gal/ft)	Total Volume/FT (gal/ft)	Total Volume/ Interval (gal)	Drawdown Flow Rate (gpm)	(MGD)	Flowmeter Reading (MGD)	(gpm)	Discharge Pressure (psi)	(FT)
00.00	0 00	0 00	65.5	1	328.79	324 33	0 00											
00 45	0.75	0.75	71	1	328.79	323.87	0.46	2,524	293	0	2,817	1,291	1,722	2.48	2.75	1,910	47	109
01.38	1.63	0.88	80	1	328.79	323.12	0.75	2,524	293	0	2,817	2,113	2,392	3.44	2.56	1,778	48	111
02 16	2 27	0.63	86	1	328.79	322 62	0.50	2,524	293	0	2,817	1,409	2,224	3.20	2 50	1,736		
02 56	2.93	0.67	92	1	328.79	322.12	0.50	2,524	293	0	2,817	1,409	2,113	3.04	2.46	1,708	48	111
03 33	3 55	0 62	98	1	328 79	321.62	0.50	2,524	293	0	2,817	1,409	2,284	3 29	2 20	1,528		
04:22	4 37	0 82	104	1	328.79	321 12	0.50	2,524	293	0	2,817	1,409	1,725	2 48	2 39	1,660		
05.43	5.72	1.35	111	1	328.79	320.54	0.58	2,524	293	1,186	4,003	2,335	1,730	2.49	2.38	1,653	48	111
06.45	6.75	1.03	118	1	328 79	319 96	0 58	2,524	0	1,186	3,710	2,164	2,094	3 02	2 35	1,632		
07 38	7 63	0.88	125	1	328 79	319 37	0 58	2,524	0	1,186	3,710	2,164	2,450	3 53	2.34	1,625		
												Average	2,035	2.93	2 45	1,701	48	110

Overall Volume

Run Time (min)	Interval Height (ft)	Volume/FT Wetwell (gal/ft)	Volume/FT MH (gal/ft)	Volume/Full Pipe Pipe (gal)	Total Volume (gal)	Drawdown Flow Rate (gpm)	(MGD)	Flowmeter Reading (MGD)	(gpm)	Discharge Pressure (psi)	(FT)
6.75	4.96	2524	293	2,373							
Drawdown Interval (ft or Pipe)	4.96	3.8	1								
Drawdown Volume (gal)	12,515	1,123	2,373	16,011	2,372	3.42	2 45	1,701	48	110	

Top of Pipe from New Wet Well= 321 12
Bottom of Pipe from New Wet Well= 319 12
MH 119H Shelf 320.4
MH 119G Shelf 320.5

Flowmeter Error -28 3 %

Town of Middlebury
Main Wastewater Pump Station
Pump Drawdown Testing

Date: 10/11/2012
Project No.: 11070
Persons Present: Kevin J. Camara, P.E., Bob Wells, Jerry Skira

Pumps 1 and 2 High Speed

Static Pressure	30	psi	69 feet
Pump Speed	60	Hertz	
Motor Torque	62	%	
RPM	1800	rpm	
Power	96	KW	

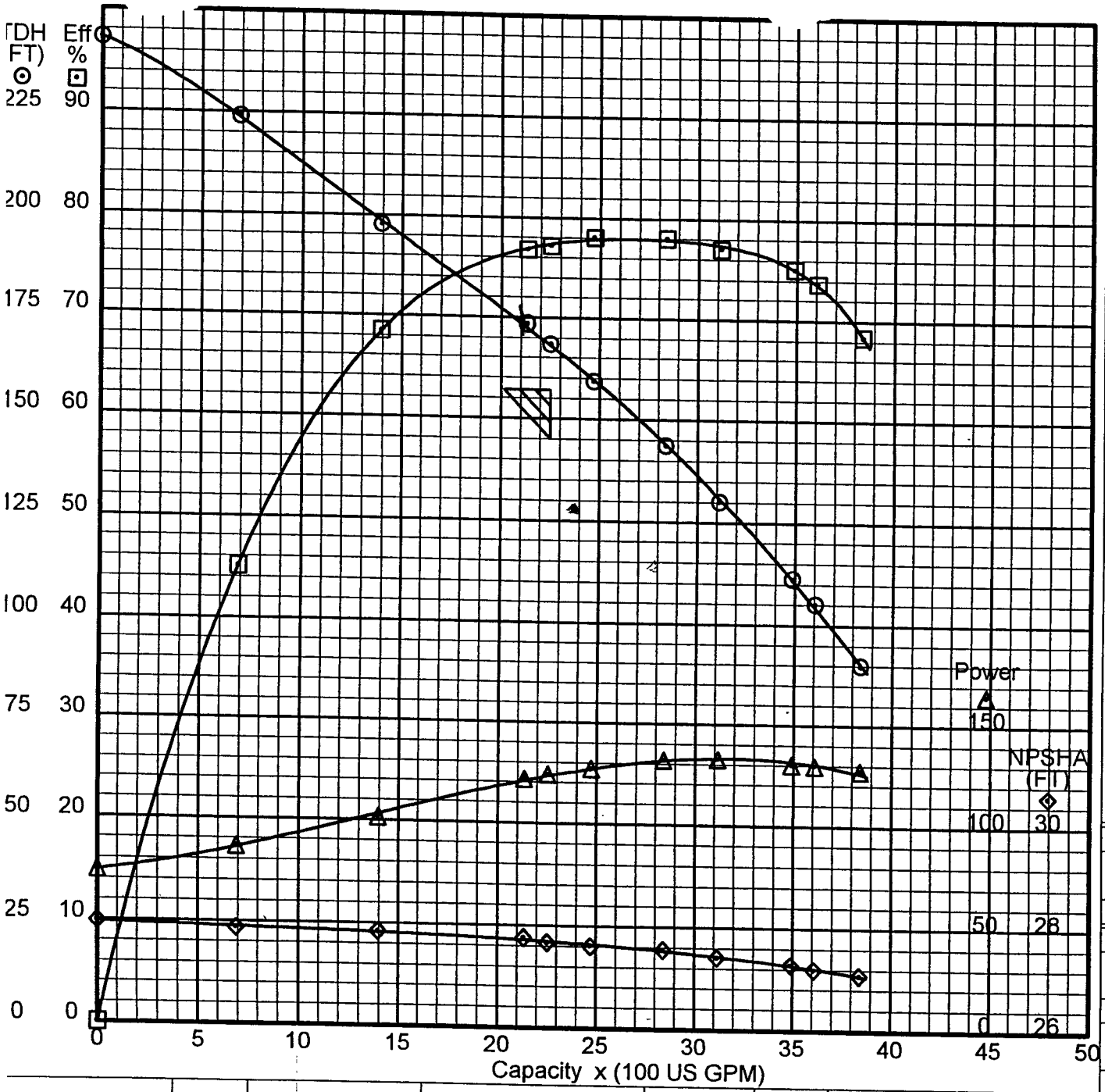
Run Time (min.sec)	Run Time (min)	Interval Time (min)	Depth from Top of Hatch (in)	Dist. Hatch to TOC (ft)	Elev. TOC (ft)	Liquid Elevation (ft)	Interval Height (ft)	Volume/FT Wetwell (gal/ft)	Volume/FT MH (gal/ft)	Volume/FT Pipe (gal/ft)	Total Volume/FT (gal/ft)	Total Volume/ Interval (gal)	Drawdown Flow Rate (gpm)	(MGD)	Flowmeter Reading (MGD)	(gpm)	Discharge Pressure (psi)	(FT)
00 00	0.00	0.00	66	1	328.79	324 29	0 00											
00:33	0 55	0.55	72	1	328.79	323 79	0 50	2,524	293	0	2,817	1,409	2,561	3 69	4.68	3,250	78	180
01:26	1.43	0 88	87	1	328 79	322 54	1.25	2,524	293	0	2,817	3,521	3,986	5.74	4.42	3,069	74	171
02 14	2.23	0.80	100	1	328.79	321.46	1 08	2,524	293	0	2,817	3,052	3,815	5 49	4.24	2,944		
02.45	2.75	0 52	106	1	328 79	320.96	0.50	2,524	293	1,186	4,003	2,002	3,874	5.58	4 20	2,917	76	176
03:29	3 48	0 73	112	1	328.79	320.46	0.50	2,524	293	1,186	4,003	2,002	2,729	3.93	4 15	2,882		
04 00	4.00	0.52	118	1	328.79	319.96	0.50	2,524	0	1,185	3,709	1,855	3,589	5.17	4.14	2,875	76	176
04 48	4.80	0.80	130	1	328.79	318 96	1 00	2,524	0	600	3,124	3,124	3,905	5.62	4.05	2,813		
												Average	3,494	5.03	4 27	2,964	76	176

Overall Volume

Run Time (min)	Interval Height (ft)	Volume/FT Wetwell (gal/ft)	Volume/FT MH (gal/ft)	Volume/Full Pipe Pipe (gal)	Total Volume (gal)	Drawdown Flow Rate (gpm)	(MGD)	Flowmeter Reading (MGD)	(gpm)	Discharge Pressure (psi)	(FT)
4.80	5 33	2524	293	2,373							
Drawdown Interval (ft or Pipe)	5 33		3 8	1							
Drawdown Volume (gal)	13,461		1,110	2,373	16,945	3,530	5 08	4 27	2,964	76	176

Flowmeter Error -16.0 %

Top of Pipe from New Wet Well=	321.12
Bottom of Pipe from New Wet Well=	319 12
MH 119H Shelf	320 4
MH 119G Shelf	320.5



INGERSOLL-DRESSER PUMP COMPANY

PUMP TEST DATA

RPM	GPM	TDH	BHP	Eff
1795	0.0	247.2	76.5	0.0
1794	695.0	227.5	88.5	45.1
1793	1405.7	200.5	103.9	68.5
1792	2147.2	175.8	124.1	76.8
1792	2266.6	170.7	126.6	77.2
1792	2488.2	161.3	129.8	78.1
1792	2857.8	145.6	134.7	78.0
1792	3136.2	131.8	135.5	77.0
1792	3512.6	112.6	133.1	75.1
1791	3629.4	106.3	132.2	73.7
1791	3863.8	91.0	129.8	68.4

I CERTIFY THAT WITHIN THE ACCURACY OF THE TEST INSTRUMENTATION, THIS TEST REPRESENTS THE PERFORMANCE OF 6MFC18 PUMP 9905MS000887-2

David G. Hance

SP.GR.: 1.000

W/ JOB 10"x8" ELBOW MAIN WELL

CASING DATA		
A278 CL30	SIS-3	-
MATERIAL	FINISH	TONGUE

IMPELLER DATA		
A278 CL30	1A	-
MATERIAL	FINISH	DISC. TIPS
UB5714A	A-24	15.04"
PATT. NO.	COMB. NO.	DIA

6MFC18	1	S000887	9905MS000887-2	25MAY99	WPC	DAH	400H/1800R,#34	10x5.65,#47	1780	T-S000887-2A
PUMP	STAGES	ORDER NO.	SERIAL NO.	DATE TESTED	TEST	APPROVED	TEST DRIVER	VENTURI	PLOTTED RPM	CURVE NO

APPENDIX K

FORCEMAIN HEADLOSS AND SYSTEM CURVE CALCULATIONS

MIDDDLEBURY MAIN PUMP STATION
PUMP SYSTEM CURVE ANALYSIS
ONE PUMP RUNNING

FLOW RATES

High Speed	2,479 gpm	3.56976
	3,000 gpm	4.32
	3,500 gpm	5.04

STATIC HEAD LOSS

Forcemain Highest Elevation	387.0 Feet	Measured Static Head	30 psi
Pump Pressure Gauge Elevation	320.0 Feet		69.3 Feet
Static Head Loss (Hs)	67.0 Feet		

FRICTION HEAD LOSS

Pipe Type	Nominal Diameter (d) (inches)	Inside Diameter (Id) (inches)	C Factor	Pipe Length (ft)	Fittings Equivalent Length (ft)	Total Equivalent Pipe Length (L) (ft)	Friction Head Loss High Speed (Hf) (ft)	Friction Head Loss Medium Speed (Hf) (ft)	Friction Head Loss Low Speed (Hf) (ft)
Ductile Iron	6	6.22	120	2	6	8	3.11	4.42	5.88
Ductile Iron	10	10.34	120	25	20	45	1.47	2.10	2.79
Ductile Iron	12	12.4	120	8	187	195	2 64	3.76	5.00
Ductile Iron	16	16 61	120	172	108	280	0.91	1.30	1.73
Ductile Iron	18	18.69	120	600	107	707	1.30	1.85	2.46
PVC	18	16.534	140	10,969	680	11,649	29.24	41 62	55.35
Totals				11,776			38.68	55.05	73.22

Hf = 0.002083 x L x (100/C)^1.85 x (gpm^1.85 / id^4.8655)

FITTINGS EQUIVALIENT LENGTH

Pipe Size/Type/Fitting	No. Fittings	Equivalent Length Per Fitting (ft)	Total Equivalent Length (ft)
6" Ductile Iron			
6" x 12" Reducer	1	6	6
		Total	6
10" Ductile Iron			
10" x 18" Reducer	2	7	14
Plug Valve FO	1	6	6
		Total	20
12" Ductile Iron			
90° Elbow	1	31	31
Swing Check Valve FO	1	77	77
Plug Valve FO	1	7	7
Sudden Enlargement	1	7	7
Tee Side Out	1	65	65
		Total	187
16" Ductile Iron			
Tee Side Out	1	88	88
Plug Valve FO	1	9	9
11.25° Elbow	1	4	4
16" x 18" Reducer	1	7	7
		Total	108
18" Ductile Iron			
90° Elbow	2	48	96
Plug Valve FO	1	11	11
		Total	107
18" PVC			
45° Elbow	26	20	520
22.5° Elbow	12	10	120
11.25° Elbow	8	5	40
		Total	680

TOTAL DYNAMIC HEAD (TDH)

TDH= Static Head (Hs) + Friction Head (Hf)

	Flow Rate (gpm)	Hs (ft)	Hf (ft)	TDH (ft)	System Pressure Observed psi	(ft)
High Speed	2,479	67 0	38.68	105.68	55	127.05
	3,000	67.0	55.05	122.05		
	3,500	67.0	73.22	140.22		

MIDDDLEBURY MAIN PUMP STATION
PUMP SYSTEM CURVE ANALYSIS
ONE PUMP RUNNING LOWERING C FACTORS TO MATCH MEASURED SYSTEM PRESSURE

FLOW RATES

High Speed	2,479	gpm
	3,000	gpm
	3,500	gpm

STATIC HEAD LOSS

Forcemain Highest Elevation	387.0	Feet	Measured Static Head	30 psi
Pump Pressure Gauge Elevation	320.0	Feet		69.3 Feet
Static Head Loss (Hs)	67.0	Feet		

FRICTION HEAD LOSS

Pipe Type	Nominal Diameter (d) (inches)	Inside Diameter (id) (inches)	C Factor	Pipe Length (ft)	Fittings Equivalent Length (ft)	Total Equivalent Pipe Length (L) (ft)	Friction Head Loss High Speed (Hf) (ft)	Friction Head Loss Medium Speed (Hf) (ft)	Friction Head Loss Low Speed (Hf) (ft)
Ductile Iron	6	6.22	91	2	6	8	5.19	7.38	9.82
Ductile Iron	10	10.34	91	25	20	45	2.46	3.50	4 66
Ductile Iron	12	12.4	91	8	187	195	4.40	6.27	8.34
Ductile Iron	16	16.61	91	172	108	280	1.53	2 17	2.89
Ductile Iron	18	18 69	91	600	107	707	2.17	3 09	4.11
PVC	18	16 534	111	10,969	680	11,649	44.93	63 94	85.04
Totals				11,776			60 67	86.35	114 84

Hf = 0 002083 x L x (100/C)^1.85 x (gpm^1.85 / id^4.8655)

FITTINGS EQUIVALIENT LENGTH

Pipe Size/Type/Fitting	No. Fittings	Equivalent Length Per Fitting (ft)	Total Equivalent Length (ft)
6" Ductile Iron			
6" x 12" Reducer	1	6	6
		Total	6
10" Ductile Iron			
10" x 18" Reducer	2	7	14
Plug Valve FO	1	6	6
		Total	20
12" Ductile Iron			
90° Elbow	1	31	31
Swing Check Valve FO	1	77	77
Plug Valve FO	1	7	7
Sudden Enlargement	1	7	7
Tee Side Out	1	65	65
		Total	187
16" Ductile Iron			
Tee Side Out	1	88	88
Plug Valve FO	1	9	9
11.25° Elbow	1	4	4
16" x 18" Reducer	1	7	7
		Total	108
18" Ductile Iron			
90° Elbow	2	48	96
Plug Valve FO	1	11	11
		Total	107
18" PVC			
45° Elbow	26	20	520
22.5° Elbow	12	10	120
11.25° Elbow	8	5	40
		Total	680

TOTAL DYNAMIC HEAD (TDH)

TDH= Static Head (Hs) + Friction Head (Hf)

	Flow Rate (gpm)	Hs (ft)	Hf (ft)	TDH (ft)	System Pressure Observed psi	(ft)
High Speed	2,479	67 0	60.67	127 67	55	127.05
Medium Speed	3,000	67 0	86.35	153 35	40	92.4
Low Speed	3,500	67.0	114.84	181.84	30	69 3

MIDDDLEBURY MAIN PUMP STATION
PUMP SYSTEM CURVE ANALYSIS
TWO PUMPS RUNNING

FLOW RATES

High Speed	3,530 gpm
Medium Speed	2,372 gpm
Low Speed	464 gpm

STATIC HEAD LOSS

Forcemain Highest Elevation	387 0 Feet	Measured Static Head	30 psi
Pump Pressure Gauge Elevation	320.0 Feet		69 3 Feet
Static Head Loss (Hs)	67 0 Feet		

FRICTION HEAD LOSS

Pipe Type	Nominal Diameter (d) (inches)	Inside Diameter (id) (inches)	C Factor	Pipe Length (ft)	Fittings Equivalient Length (ft)	Total Equivalient Pipe Length (L) (ft)	Friction Head Loss High Speed (Hf) (ft)	Friction Head Loss Medium Speed (Hf) (ft)	Friction Head Loss Low Speed (Hf) (ft)
Ductile Iron	6	6.22	120	2	6	8	5 98	2 86	0.14
Ductile Iron	10	10.34	120	25	20	45	2 84	1 36	0 07
Ductile Iron	12	12 4	120	8	187	195	5 08	2 43	0 12
Ductile Iron	16	16 61	120	172	108	280	1.76	0.84	0 04
Ductile Iron	18	18 69	120	600	107	707	2.50	1.20	0.06
PVC	18	16 534	140	10,969	680	11,649	56 23	26 95	1.32
Totals				11,776			74.38	35 65	1.74

Hf = 0 002083 x L x (100/C)^1 85 x (gpm^1.85 / id^4 8655)

FITTINGS EQUIVALIENT LENGTH

Pipe Size/Type/Fitting	No. Fittings	Equivalient Length Per Fitting (ft)	Total Equivalient Length (ft)
6" Ductile Iron			
6" x 12" Reducer	1	6	6
		Total	6
10" Ductile Iron			
10" x 18" Reducer	2	7	14
Plug Valve FO	1	6	6
		Total	20
12" Ductile Iron			
90° Elbow	1	31	31
Swing Check Valve FO	1	77	77
Plug Valve FO	1	7	7
Sudden Enlargement	1	7	7
Tee Side Out	1	65	65
		Total	187
16" Ductile Iron			
Tee Side Out	1	88	88
Plug Valve FO	1	9	9
11 25° Elbow	1	4	4
16" x 18" Reducer	1	7	7
		Total	108
18" Ductile Iron			
90° Elbow	2	48	96
Plug Valve FO	1	11	11
		Total	107
18" PVC			
45° Elbow	26	20	520
22 5° Elbow	12	10	120
11.25° Elbow	8	5	40
		Total	680

TOTAL DYNAMIC HEAD (TDH)

TDH= Static Head (Hs) + Friction Head (Hf)

	Flow Rate (gpm)	Hs (ft)	Hf (ft)	TDH (ft)	System Pressure Observed psi	(ft)
High Speed	3,530	67 0	74 38	141 38	76	175.56
Medium Speed	2,372	67 0	35.65	102 65	48	110 88
Low Speed	464	67 0	1 74	68 74	31	71 61

MIDDDLEBURY MAIN PUMP STATION
PUMP SYSTEM CURVE ANALYSIS
TWO PUMPS RUNNING LOWERING C FACTORS TO MATCH MEASURED SYSTEM PRESSURE

FLOW RATES

High Speed	3,530 gpm
Medium Speed	2,372 gpm
Low Speed	464 gpm

STATIC HEAD LOSS

Forcemain Highest Elevation	387 0 Feet	Measured Static Head	30 psi
Pump Pressure Gauge Elevation	320.0 Feet		69.3 Feet
Static Head Loss (Hs)	67 0 Feet		

FRICTION HEAD LOSS

Pipe Type	Nominal Diameter (d) (inches)	Inside Diameter (id) (inches)	C Factor	Pipe Length (ft)	Fittings Equivalient Length (ft)	Total Equivalient Pipe Length (L) (ft)	Friction Head Loss High Speed (Hf) (ft)	Friction Head Loss Medium Speed (Hf) (ft)	Friction Head Loss Low Speed (Hf) (ft)
Ductile Iron	6	6 22	95	2	6	8	9.21	4.41	0.22
Ductile Iron	10	10.34	95	25	20	45	4.37	2.09	0 10
Ductile Iron	12	12.4	95	8	187	195	7 82	3.75	0.18
Ductile Iron	16	16.61	95	172	108	280	2.71	1.30	0.06
Ductile Iron	18	18 69	95	600	107	707	3.85	1.85	0.09
PVC	18	16.534	115	10,969	680	11,649	80 92	38.78	1 90
Totals				11,776			108.88	52.18	2.55

Hf = 0.002083 x L x (100/C)^1.85 x (gpm^1 85 / id^4.8655)

FITTINGS EQUIVALIENT LENGTH

Pipe Size/Type/Fitting	No. Fittings	Equivalient Length Per Fitting (ft)	Total Equivalient Length (ft)
6" Ductile Iron			
6" x 12" Reducer	1	6	6
		Total	6
10" Ductile Iron			
10" x 18" Reducer	2	7	14
Plug Valve FO	1	6	6
		Total	20
12" Ductile Iron			
90° Elbow	1	31	31
Swing Check Valve FO	1	77	77
Plug Valve FO	1	7	7
Sudden Enlargement	1	7	7
Tee Side Out	1	65	65
		Total	187
16" Ductile Iron			
Tee Side Out	1	88	88
Plug Valve FO	1	9	9
11 25° Elbow	1	4	4
16" x 18" Reducer	1	7	7
		Total	108
18" Ductile Iron			
90° Elbow	2	48	96
Plug Valve FO	1	11	11
		Total	107
18" PVC			
45° Elbow	26	20	520
22.5° Elbow	12	10	120
11.25° Elbow	8	5	40
		Total	680

TOTAL DYNAMIC HEAD (TDH)

TDH= Static Head (Hs) + Friction Head (Hf)

	Flow Rate (gpm)	Hs (ft)	Hf (ft)	TDH (ft)	System Pressure Observed psi	(ft)
High Speed	3,530	67 0	108.88	175 88	76	175 56
Medium Speed	2,372	67.0	52 18	119.18	48	110.88
Low Speed	464	67 0	2.55	69 55	31	71 61

APPENDIX L

ICE PIGGING PROPOSAL AND INFORMATION

Proposal From:

ICE PIGGING

Utility Service Co.
INCORPORATED

535 Courtney Hodges Blvd.
P.O. Box 1350, Perry, Georgia 31069
Phone: 800-223-3695

www.utilityservice.com

FAX SIGNED COPY TO:
478-987-2991

Date March 26th 2013 | SFID:29865 | CN: 75561 | SO: | Page No. 1 of 2

Proposal Submitted to: **Middlebury Wastewater Dept.**			Attn: **Mr R. Wells**	Phone 802-388-6514 Fax
Address: **94 Main Street**			Job Name: **Force Main - Ice Pigging Project**	
City: **Middlebury**	State: **VT**	Zip Code: **05753**	Job Location: **Middlebury WWTP**	County / Parish
Length: **Approx. 12,000 feet**	Size and Material: **16" & 18" DIP & PVC**		Est. Start Date: **TBC**	Submitted by: **S. Kelley**

Utility Service Co., Inc. agrees to provide all labor, equipment, and materials needed to complete the following:

1. USCI shall produce approximately 2700 gallons of ice slurry for delivery and removal from the water mains each day of work to clean sediments, loose deposits, and biofilms from the water mains covered under this proposal. The water mains to be cleaned and procedures are listed in Addendum A.

2. Based upon the information provided by the Owner to USCI, USCI estimates this project will take **9 full loads** to complete, on a Monday through Friday delivery schedule over a period of three weeks.

3. Owner agrees to provide the following:
   a. Potable water to produce the ice slurry,
   b. Temporary location to store the ice making equipment,
   c. Network Operators to isolate and re-open pumps, valves and hydrants as necessary during the project,
   d. MOT (Maintenance of Traffic) procedures where necessary,
   e. Suitable connections for ice insertion at the PS and nominated ARV's
   f. Additional insertion points at positions to be determined by USCI as discussed at previous meeting.

One hundred and Eight Thousand and No/100 . . . . . dollars (**$ 108,000.00 + tax**).

Payment to be made as follows: ***Payment in Full Upon Completion of Work – plus all applicable taxes***

Remittance Address: Utility Service Company, Inc., P. O. Box 116554, Atlanta, GA 30368-6554

All material is guaranteed to be as specified. All work to be completed in a substantial workmanlike manner according to specifications submitted, per standard practices. Any alteration or deviation from above specifications involving extra costs will be executed only upon written orders, and will become an extra charge over and above the estimate. All agreements contingent upon strikes, accidents or delays beyond our control. Owner to carry fire, tornado and other necessary insurance. Our workers are fully covered by Workmen's Compensation Insurance.

Authorized USCI Signature

Note: This proposal may be withdrawn by us if not accepted within Fifteen (15) days

Acceptance of Proposal – The above prices, specifications and conditions are satisfactory and are hereby accepted. You are authorized to do the work as specified. Payment will be made as outlined above.

Signature _____

Date of Acceptance _____ **Printed Name** _____

CONFIDENTIAL

Proposal From:

ICE PIGGING

Utility Service Co.
INCORPORATED

535 Courtney Hodges Blvd.
P.O. Box 1350, Perry, Georgia 31069
Phone: 800-223-3695

www.utilityservice.com

FAX SIGNED COPY TO:
478-987-2991

Date March 26th 2013 | SFID: 29865 | CN: | SO: | Page No. 2 of 2

Proposal Submitted to **Middlebury Wastewater Dept.**			Attn **Mr R. Wells**	Phone 802-388-6514 Fax
Address **94 Main Street**			Job Name **Force Main - Ice Pigging Project**	
City **Middlebury**	State **VT**	Zip Code **05753**	Job Location **Middlebury WWTP**	County / Parish
Length **Approx. 12,000 feet**	Size and Material **16" & 18" DIP & PVC**		Est. Start Date **TBC**	Submitted by **S. Kelley**

4. Owner agrees that there is considerable expense to make 2700 gallons of ice and that the ice cannot be held for more than 12 hours before it becomes unusable. If on a scheduled work day the Owner cannot isolate the water main or does not have the needed personnel, USCI shall charge the Owner the full rate of $12,000 per day.

5. USCI shall not charge the Owner the daily rate, if USCI cannot perform the complete day's work due to those factors under USCI's control, i.e. the ice is not in suitable condition, USCI cannot provide the necessary labor, equipment failure, etc.

6. Due to the potential condition or deterioration of assets that may or may not have been maintained, Owner shall indemnify USCI, and all officers and agents of USCI, against all damages, costs or expenses that may result from damage to property or personal injury caused by reason of faulty performance of any work in connection with this Agreement. Such indemnity includes, but is not limited to, damage to property or personal injury occasioned by any negligence, act or omission to act by USCI or any of its servants, agents, employees, or any subcontractor retained by USCI to perform any of the work contemplated by or under this agreement.

7. Once delivered to the job site, USCI transfers ownership of the ice slurry to the Owner. All ice delivered to and removed from the water main, along with the wastes generated from the resulting process shall be the sole property of the Owner. Owner shall dictate the exact disposal procedures to be employed during the process.